FUNCTIONAL CHANGES IN THE MAJOR UNITED STATES GREAT LAKES PORTS SINCE THE OPENING OF THE NEW ST. LAWRENCE SEAWAY

by 147

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CHAPTER I

INTRODUCTION

The year 1959 brought a new dimension in Great Lakes waterway development with the first operating season for the new St. Lawrence Seaway. The new seaway's opening marked the latest step in a continuum of waterway improvement that had started in the North American colonial period. In scope, however, the latest project overshadowed earlier developments. The depth of the Great Lakes-Atlantic Ocean channels and locks were nearly doubled from fourteen to twenty-seven feet. The increased depth opened the North American heartland drained by the Great Lakes-St. Lawrence River system to ocean-going ships of moderate size.[1]

The new seaway like earlier waterway improvements served to overcome the 550 feet elevational change and navigational barriers between Lake Erie and the Atlantic Ocean.[2] The immediate predecessor to the new seaway had required 22 lockages between Lake Erie and the sea. The new system reduced lockages to 15, substantially reducing vessel

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[1] For a well researched history of the waterway, see William R. Willoughby, The St. Lawrence Waterway, Madison, Wisconsin: The University of Wisconsin Press, 1961.

[2] St. Lawrence Seaway Development Corporation Annual Report, 1959, Massena, New York, p. 7.

transit time.[3] Additionally, the new system increased the dimensions of channels and locks to a degree that over-all waterway capacity was increased significantly.[4] Vessels using the old system were limited to a carrying capacity of about 1,800 net registered tons of general cargo and 3,000 net registered tons of bulk cargo.[5] Increased dimensions in the new seaway allowed general cargo vessels of 8,500-9,000 net registered tons and bulk cargo carriers of 25,000 tons to transit the waterway.[6]

The desire for low cost water transportation, particularly access to ocean shipping, was the primary economic justification for construction of the new seaway. The rich interior of North America produced an abundance of industrial raw materials, agricultural products, and manufactured goods without direct access to ocean commerce. Proponents of the seaway argued persuasively that the seaway would provide the needed outlet and result in the movement of

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[3] Ibid., p. 6.

[4] For a summary of the proportions of all parts of the seaway, see Ibid., pp. 16-18.

[5] Harold M. Mayer, The Port of Chicago and the St. Lawrence Seaway, Chicago: The University of Chicago Press, 1957, p. 41.

[6] St. Lawrence Seaway Development Corporation Annual Report, 1959, p. 6. The annual report for 1964 list the record tonnage carried through the seaway at 28,694 cargo tons of iron ore by the S. S. Saguenay, a Canadian Bulk carrier.

increasing tonnages of all products.[7] The growing steel industry in the American Midwest had looked hungrily toward the output of Labrador iron ore as the easily exploited reserves of the Lake Superior area diminished and joined the backers of the seaway project.[8] Estimates were advanced that the construction of the seaway would bring wide benefits as a result of competing transportation modes being forced to lower their rates.[9] Finally, the threat of the Canadian Government to construct the seaway independently led to participation of the United States in the planning and construction of the seaway in its present form.[10]

I. BACKGROUND FOR THE STUDY

Before, during, and after completion of the new seaway numerous studies were published in an endeavor to estimate or project the impact of the seaway on specific ports,[11]

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[7]Martin G. Glaeser, "The St. Lawrence Seaway and Power Project," Land Economics, 30:298, November, 1954.

[8]Donald F. Wood, "The St. Lawrence Seaway; Some Considerations of Its Impact," Land Economics, 34:68, January, 1956.

[9]Changing Shipping Patterns on the St. Lawrence Seaway, United States Department of Agriculture, Marketing Research Report Number 621, Washington: Government Printing Office, August, 1963, p. 22.

[10]William R. Willoughby, op. cit., p. 245.

[11]For an example of projected impact on a specific port, see Harold M. Mayer, op. cit., pp. 118-128, 241-62. See also Donald F. Wood, op. cit.

port areas,[12] or commodity movements.[13] The impact studies emphasized the effect of expected lower shipping cost that would occur in the area opened to direct ocean access.[14] They introduced, often implicitly, the concept of change accruing from a situational or spatial reorientation of water linkages. With the latest waterway improvement the Great Lakes had become directly linked to ocean commerce and could therefore, expect to receive a wide range of benefits. The direct ocean link, proponents advanced, would result in increasing amounts of waterborne commerce which would increase primary and secondary economic activity which would in turn result in still more waterborne commerce.[15] The Seaway was projected as a positive change in spatial linkages, changing the orientation of the Great Lakes from a system of inland waterways to avenues of world

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[12]For a good example of the port area study, see Joseph A. Russell, et al., The St. Lawrence Seaway; Its Impact by 1965 Upon the Industry of Metropolitan Chicago and the Illinois Waterway Associated Areas (Two Vols.), Chicago: The Chicago Association of Commerce and Industry, 1960.

[13]See Joseph R. Hartley, The Effects of the St. Lawrence Seaway on Grain Movements, Indiana Business Report Number 24, Bloomington Indiana: Indiana University School of Business, 1957.

[14]Ibid., pp. 70-1.

[15]Joseph A. Russell, et al., op. cit., pp. 34-5 (Vol. I).

commerce.[16]

II. STATEMENT OF THE PROBLEM

The following study represents a different approach to understanding the spatial reorientation of Great Lakes waterborne commerce following the opening of the new seaway. Given the fact that data was available for a six year period, 1959-1964, following completion of the seaway attention was directed to the changes that have taken place. The central problem and question for the study was what functional changes have occurred in the major Great Lakes ports since the new waterway link was completed.

Functional change in the major Great Lakes ports was selected as the problem focus for a number of reasons. First, changes in the level and characteristics of waterborne commerce must necessarily affect the ports serving the commerce movement. Second, the term port is a designation for a functional entity. Reduced to simplicity, ports are nodes or knots of land-water interchange.[17] Their

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[16]Gunnar Alexandersson, and Goran Norstrom, World Shipping; An Economic Geography of Ports and Seaborne Trade, New York: John Wiley and Sons, 1963, pp. 254-55. The authors estimated that increased seaway dimensions would allow 80 per cent of the world's general cargo vessels to transit the waterway.

[17]Guido G. Weigend, "Some Elements in the Study of Port Geography," Geographical Review, 48:185, April, 1958.

function is to join and transfer goods between land and water. They serve as linking mechanisms for the areal or spatial exchange of flows by water or combined water-land transportation.[18] The French word for door, "la porte," adequately conveys an analogous illustration; a place or point of entry or exit for spatial movement. Finally, the functional relationship of ports and commerce movement is reinforced by publication of data on a port to port basis. By concentrating on functional changes in ports insight can be gained into the spatial orientation of waterborne commerce.

The character of an individual port consists of a number of constituent elements that combine or interact to satisfy the port function. The more important elements include: (1) a level of port activity measured by volume of interchange, (2) the relative importance of a port compared to other ports, or a position in a rank-size hierarchy, (3) the composition of commodities handled by the port, (4) the nature of spatial linkages provided by the port, (5) the physical facilities of the port site which set limitations on the levels of interchange, and (6) a wide range of administrative services providing assistance and

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[18] Ibid. See also Lester E. Klimm, "Man's Ports and Channels," Man's Role in Changing the Face of the Earth, Edited by William Thomas, Chicago: The University of Chicago Press, 1956, p. 522.

organization.[19] These elements, as they interact, characterize the port and the manner in which it functions.

To understand how waterborne commerce in the Great Lakes has reacted to the opening of the Seaway as reflected in the major ports, attention was directed toward the elements of port function. The elements considered included: (1) changes in cargo volume and rank-size hierarchy, (2) changes in commodity composition, (3) changes in the relationship of foreign and domestic commerce, and (4) changes in foreign commerce and spatial linkages. Analysis of changes in the four elements provided a measured indication of change in port function and therefore of changes in waterborne commerce. Space and time limitations necessitated the omission of physical and administrative changes.

III. METHODS OF ANALYSIS AND JUSTIFICATION

Seven major United States Great Lakes ports were

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[19] For a different approach to the problem of port comparison, see Richard E. Carter, "A Comparative Analysis of United States Ports and Their Traffic Characteristics," Economic Geography, 38:162-75, April, 1962.

selected as the study group.[20] The six leading ports in total tonnage handled were selected. Because of the absence of a firm dividing line between the fifth, sixth, and seventh ports in total tonnage, compromise resulted in the inclusion of the top seven in each section except the last. Indiana Harbor was not differentiated from other Chicago area ports in foreign commerce data.[21]

Tonnage was elected as the rank-size criterion for two reasons. Value for United States domestic waterborne commerce was not and is not available. Tonnage data was available in ample volume and detail. Actual cargo tonnage handled is, however, probably the best single indicator of port prominence.[22] Value was considered of unquestioned importance and was utilized in examination of foreign commerce where value data was available.

The time matrix for the study included the years 1953-1964. This span provided a balanced period of six

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[20]The Port of Chicago, Duluth-Superior, Toledo, the Port of Detroit, Indiana Harbor, Cleveland, and the Port of Buffalo. The Corps of Engineers' delimitations of port organization was accepted and uniformly followed.

[21]Indiana Harbor is not separated from Gary, Indiana and Buffington, Indiana in foreign trade data.

[22]See Peter J. Rimmer, "The Problem of Comparing and Classifying Seaports," Professional Geographer, 18:83-91, March, 1966. See also Gunnar Alexandersson and Goran Norstrom, op. cit., pp. 118-9.

years before and six years after the opening of the seaway. The twelve year interval permitted a sequence of three year averages for data presentation and analysis while eliminating the difficulty of comparing the fluctuation of year to year changes in tonnage or value figures.

Maps were inserted into the study for visual comparison of commerce flows and for spatial orientation. Graphs were utilized in several instances which required illustration of continuity in the growth of tonnage and value. An index of commodity composition was developed in an effort to facilitate time and space comparisons of changes within port activity.

Emphasis in the study was weighted toward understanding change resulting from spatial reorientation or situation in the geographical sense. Geographers have researched this problem in the past as applicable to ports. Weigend pointed out effectively in his study of port geography how situational change resulted in significant changes in French ports.[23] He presented the case of Marseilles which had been relatively unimportant in French commerce prior to the completion of the Suez Canal. After the canal opened Asian trade that had once passed to Atlantic ports moved Marseilles

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[23]Guido G. Weigend, op. cit.

into a position of prominence.[24] Morgan noted that construction of the Panama Canal led to significant changes in Pacific Coast ports. Vancouver became important in the export of grain to Europe and Seattle lost Asian liner traffic to Gulf and Atlantic ports.[25]

The study has drawn heavily from previously published port research. Repeated reference is made to the earlier noted impact studies to compare well reasoned estimates to what has taken place. Annual waterborne commerce data was obtained from the United States Army Corps of Engineers harbors and waterways statistics.[26] Data on foreign trade division of the Bureau of the Census.[27]

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[24] Ibid., p. 189.

[25] F. W. Morgan, Ports and Harbours, London: Hutchinson University Library, 1958, p. 163.

[26] United States Waterborne Commerce (Parts I through V and National Summary Supplements), Department of the Army, United States Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954.

[27] A number of publications were used from a wide range of coverage. The more important sources were United States Foreign Waterborne Commerce, Great Lakes Area, United States Bureau of the Census, Division of Foreign Trade, Washington, D. C., Annual since 1955; United States Foreign Trade (Summary Report FT 985), United States Bureau of the Census, Division of Foreign Trade, Washington, D. C., Annual and Monthly.

CHAPTER II

CHANGES IN CARGO VOLUME AND RANK-SIZE HIERARCHY

One of the more important elements in an examination of port function rests in the quantitative measure of the volume of port activity. A number of volume measures may be employed. The number of vessels calling, registered tonnage of visiting vessels, value of cargo handled, and actual weight of cargo handled are possible alternatives. Rimmer, in a fairly rigorous quantitative treatment of the various measures, concluded that cargo tonnage or the actual weight of commerce was the best single indication of volume and that vessel visitation figures yielded the least insight.[28] Morgan, in his discussion of ports clearly favored the use of net registered tonnage because of the availability of data for world trade.[29] Weigend, however, found that net registered tonnage was unsatisfactory, often hiding much more than was revealed.[30] The most obvious solution would be to employ all available measures.

For the Great Lakes, and in fact for the entire

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[28]Peter J. Rimmer, op. cit., p. 88.

[29]F. W. Morgan, op. cit., pp. 14-17.

[30]Guido G. Weigend, op. cit., p. 196.

United States, data availability for domestic waterborne commerce does not permit application of all of the alternatives. All United States domestic waterborne commerce data is expressed in cargo tons (2,000 lbs.) with summary information on vessel numbers and draft. Value and net registered tonnage figures are published only for foreign waterborne commerce. The common denominator in each case is cargo tonnage.

I. TONNAGE VOLUME AND DIRECTION OF FLOW

In total cargo tonnage the seven major ports stand out in Great Lakes waterborne commerce. Table I illustrates the relationship of the seven major ports to Great Lakes and United States waterborne commerce. The seven major ports accounted for over 54 per cent of total Great Lakes commerce throughout the study period. Significantly, the absolute tonnage handled by the seven ports declined slightly more than 5 per cent during the period from 1954-1956 and 1962-1964.

Some difficulty was present in contrasting trends between Great Lakes and total United States waterborne commerce. The figure for the United States total in Table I was calculated in a manner to eliminate double counting in the traffic categories of coastwise, lakewise, internal,

TABLE I

RELATIONSHIP OF GREAT LAKES AND UNITED STATES WATERBORNE COMMERCE TONNAGE BY THREE YEAR AVERAGES, 1954-1964
(Thousands of Tons of 2,000 lbs.)

	1954-56	1956-58	1959-61	1962-64
Net total U. S. tonnage[a]	992,230	1,076,277	1,071,469	1,180,422
Total Great Lakes tonnage	390,480	376,877	329,878	368,694
Great Lakes as a per cent of U. S. net	39.35	35.02	30.79	31.24
Seven largest Great Lake Ports[b]	212,390	207,140	184,358	201,048
As a per cent of Great Lakes	54.39	54.96	55.89	54.53
As a per cent of U. S. net	21.41	19.25	17.21	17.03

[a]The United States Corps of Engineers does not document the method by which this figure is obtained. The result is to eliminate all double counting between the tonnage categories of Coastwise, Lakewise, internal, and intraport.

[b]The seven ports consist of: The Port of Chicago, Duluth-Superior, Toledo, Detroit, Cleveland, Buffalo, and Indiana Harbor.

Source: United States Waterborne Commerce (Part III, Annual since 1954), United States Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana.

local, and intraport data.[31] The method used to obtain the resulting net figure is not documented by the Corps of Engineers. The figure denoting total Great Lakes tonnage represents actual tonnages of shipments and receipts from all Great Lakes ports. If the proportions between line one and two are consistent, the Great Lakes have declined relatively and absolutely in their share of national waterborne commerce. By association, the seven ports have declined in their proportion of total United States commerce from 21 to 17 per cent.

In contrast to the trend of the Great Lakes and the seven ports, net United States waterborne commerce has increased 1.2 per cent over the study period. Evidence indicates that in the post-seaway period the Great Lakes have not enjoyed a boom in waterborne commerce.

Aggregate presentations can mask variations of individual ports from the composite trend. Table II lists tonnage changes and direction of traffic flow for the seven ports individually. The Port of Chicago, Toledo, and the Port of Detroit were clearly at variance with the general trend. The three ports experienced tonnage gains of seven, nineteen, and nineteen per cent respectively. Offsetting

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[31]For a discussion of the traffic categories, see the introductory statements in any annual issue of United States Waterborne Commerce, op. cit.

TABLE II

TONNAGE VOLUME AND DIRECTION OF FLOW FOR THE SEVEN LARGEST GREAT LAKE PORTS IN THREE YEAR AVERAGES 1954-1964
(Thousands of Tons of 2,000 lbs.)

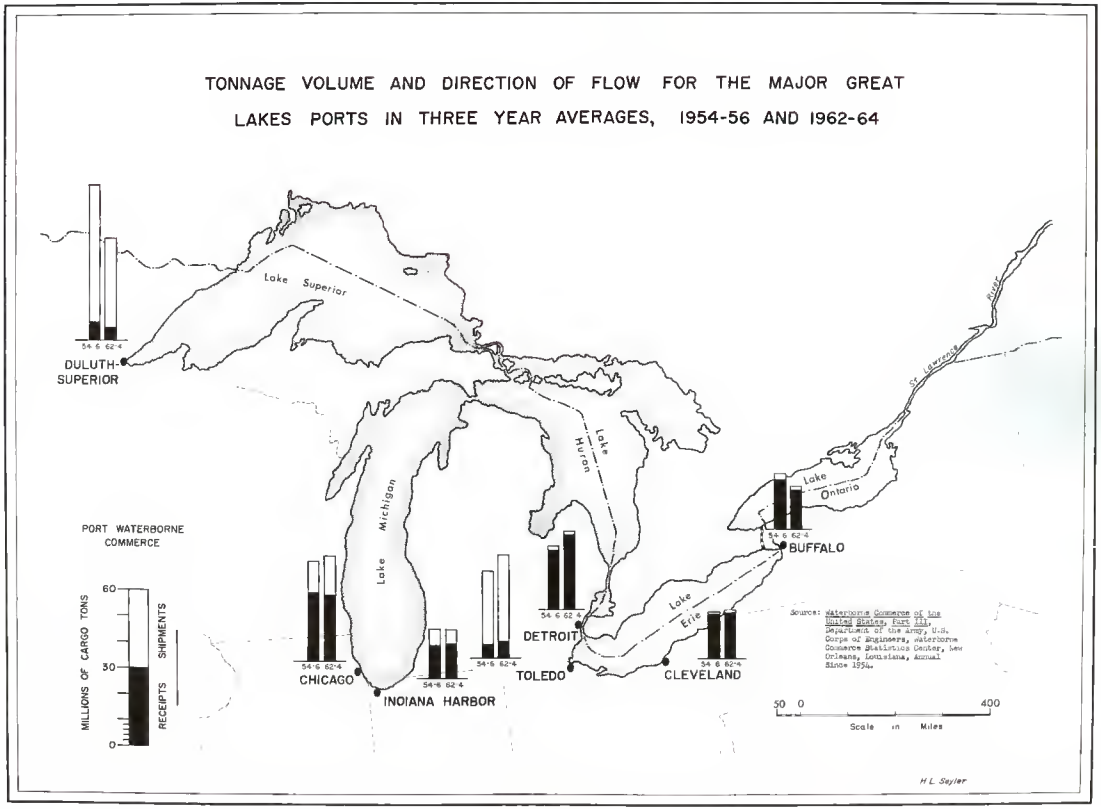
	1954-56	1956-58	1959-61	1962-64
Total tonnage Seven largest ports	212,390	207,140	184,360	201,050
Port of Chicago	37,770	40,860	38,450	40,350
Receipts	26,230	27,895	25,145	25,250
Shipments	11,540	12,965	13,305	15,100
Duluth-Superior	58,960	51,540	35,180	38,270
Receipts	7,065	6,530	4,970	4,505
Shipments	51,895	45,010	30,210	33,765
Toledo	33,080	33,060	33,930	39,470
Receipts	5,830	6,070	6,080	6,360
Shipments	27,250	26,990	27,850	33,110
Port of Detroit	24,280	25,525	26,180	29,935
Receipts	22,790	23,290	24,095	28,365
Shipments	1,490	2,235	2,085	1,570
Indiana Harbor	19,180	19,450	18,495	18,670
Receipts	12,545	12,535	11,130	13,380
Shipments	6,635	6,915	7,365	5,290
Cleveland	17,810	16,300	15,865	18,075
Receipts	16,980	15,190	15,110	17,465
Shipments	830	1,110	755	610
Port of Buffalo	21,300	20,405	16,265	16,280
Receipts	18,585	17,900	14,230	14,890
Shipments	2,715	2,505	2,035	1,390

Source: United States Waterborne Commerce, Part III (Annual Since 1954), United States Department of the Army, Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana.

the spectacular growth of the three ports above was an equally marked tonnage decline for the Port of Buffalo and Duluth-Superior with twenty-four and thirty-five per cent declines respectively. The ports of Cleveland and Indiana Harbor offset each other with a modest increase recorded by the former and a slight decrease in the latter. Map I illustrates the areal variation in tonnage changes over the problem period by contrasting the 1954-1956 average with that of 1962-1964. Interpretation of the map indicates that the greatest negative shifts occurred at the ends of the Great Lakes while the positive shifts in total commerce tended toward the center of the problem area.

Inspection of the direction of traffic flow yields no marked change in the proportions of receipts and shipments for the individual ports. The Port of Chicago remains the most balanced in direction of flow and the trend over the study period was toward greater balance. Duluth-Superior and Toledo were and have remained dominantly shipping ports. The Port of Buffalo, the Port of Detroit, and Cleveland have maintained their position as receiving ports. Indiana Harbor has moved away from a balanced flow though it stands next to Chicago in this respect.

Summarizing, total Great Lakes waterborne commerce has declined absolutely and probably relatively. The seven lake ports have varied considerably from the aggregate in


TONNAGE VOLUME AND DIRECTION OF FLOW FOR THE MAJOR GREAT LAKES PORTS IN THREE YEAR AVERAGES, 1954-56 AND 1962-64
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
St. Lawrence River
DULUTH-SUPERIOR
CHICAGO
INDIANA HARBOR
TOLEDO
DETROIT
CLEVELAND
BUFFALO
54-6 62-4
PORT WATERBORNE COMMERCE
MILLIONS OF CARGO TONS
60
30
0
RECEIPTS
SHIPMENTS
Source: Waterborne Commerce of the United States, Part III, Department of the Army, U.S. Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954.
50 0 400
Scale in Miles
H L Seyler

MAP 1

both a positive and negative manner. Taken together, the direction of traffic flow has tended toward imbalance in all ports except Chicago. In no instance has there been any reversal in the dominant direction of commerce movement. Rather, the changes have occurred in volume of total commerce.

CHANGES IN RANK--SIZE HIERARCHY

Changes in aggregate waterborne commerce also resulted in an unusual variation in Great Lakes port rank--size distribution. Table III presents changes in tonnage hierarchy for representative periods before and after completion of the seaway. All ports handling over one-half million tons were considered. The most obvious change in the distribution was a flattening of the distribution curve based on class intervals of total tonnage handled. Rather than a noticeable rank progression, concentration occurred in classes of 20 to 44 million tons. The trend over the study period was toward the mid or high mid-range size of port.

The trend observed in Great Lakes ports contrasts with that observed for Atlantic Coast ports over the same period. Table IV presents the Atlantic ports handling over one-half million tons. The trend was toward a peaked hierarchy with the Port of New York clearly dominant. The

TABLE III

CHANGES IN THE DISTRIBUTION OF GREAT LAKES PORT SIZE BY TONNAGE CLASS FROM 1954-56 TO 1962-64

Tonnage class interval (Millions of tons)	Number of ports in tonnage class	
	1954-56	1962-64
1/2 - 8	32	31
8 - 12	3	4
12 - 16	2	1
16 - 20	3	3 (B)
20 - 24	1 (B)	--
24 - 28	1 (D)	--
28 - 32	--	1 (D)
32 - 36	1 (T)	--
36 - 40	1 (C)	2 (T) (D-S)
40 - 44	--	1 (C)
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56 - 60	1 (D-S)	--
Total ports over 1/2 million tons	45	43

Port Designations: B-Port of Buffalo, D-Port of Detroit, T-Toledo, C-Port of Chicago, D-S-Duluth-Superior.

Source: Waterborne Commerce of the United States (Parts I and III), Department of the Army, United States Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954.

TABLE IV

CHANGES IN THE DISTRIBUTION OF ATLANTIC COAST PORT SIZE BY TONNAGE CLASS FROM 1954-56 TO 1962-64

Tonnage class interval (Millions of tons)	Number of ports in tonnage class	
	1954-56	1962-64
1/2 - 8	29	32
8 - 12	--	3
12 - 16	1	--
16 - 20	1	2
---		
44 - 48	1 (B)	1 (B)
---		
52 - 56	1 (N-H)	--
56 - 60	--	1 (N-H)
---		
88 - 92	1 (D)	--
---		
104 - 108	--	1 (D)
---		
144 - 148	1 (NY)	--
148 - 152	--	1 (NY)
Total ports over 1/2 million tons	35	41

Port Designations: B-Baltimore, N-H-Norfolk-Hampton Roads, D-Delaware Estuary, NY-Port of New York.

Source: Waterborne Commerce of the United States (Parts I and III), Department of the Army, United States Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954.

overall distribution exhibited a rank progression, reinforced during the study period. The Great Lakes, conversely, had no port clearly dominant and did, in fact, tend to narrow the differences separating the major ports in total traffic.

Improvement in waterway linkages created by the seaway has not, evidently, generated forces toward centrality and rank progression noted in the distribution of Atlantic Coast ports. Rimmer, in his study of New Zealand ports,[32] presented an analysis indicating that forces of centrality are operative in port development. Ports, Rimmer argued, pass through developmental stages resulting in a progressive hierarchy and dominance at the higher traffic levels. A position of port primacy would necessarily result from improvement of interior transportation gradually favoring fewer and fewer ports. Moreover, the interior changes are reinforced by the more restricted nature of maritime lines of communication which would concentrate on the more efficient ports.[33] Ports in this type of conceptual framework followed closely the ranked ordering noted in central-place studies of functional centralization.

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[32]Peter J. Rimmer, "The Changing Status of New Zealand Seaport, 1853-1960," Annals of the Association of American Geographers, 57:88-100, March, 1967.

[33]Peter J. Rimmer, Ibid., pp. 89-98.

Several factors were, and have been historically, responsible for the deviation of Great Lakes ports from the conceptual model. The Lake ports developed as nodes for a system of inland waterways. They were not tied to ocean commerce, therefore the centralizing forces were not applicable in the same sense as either the New Zealand or Atlantic Coast cases. The lake ports competed actively among themselves for lake traffic. Interior transportation facilities were duplicated and hinterlands overlapped between several ports for the traffic of interior points.[34] No one or two ports could claim a gateway situation comparable to New York or the Delaware Estuary.

Second, the presence of the Great Lakes as an alternative to shippers pressured competing railroads to levy competitive rates. As a result, a large measure of traffic moved directly to Atlantic Coast ports. Third, the necessary transhipment required in water movement from the western Great Lakes to eastern terminals or via the old fourteen foot seaway required transhipment of cargo, further enhancing the competitive position of the railroads for much of the traffic. Finally, the alternative offered by the Mississippi-Ohio River system for Gulf Coast outlets also competed for traffic in the Great Lakes port hinterlands.

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[34]See Joseph A. Russel (et. al), op. cit., p. 35-6.

Completion of the seaway did not eliminate these factors. In fact, faced with the competition offered by the new seaway, the Eastern railroads began reconsideration of freight rates before the waterway opened.[35] In June of 1959, the Eastern railroads lowered rates on export grain shipped to Atlantic Coast ports from interior points. Soon after, the western railroads lowered rates from grain producing areas to lake ports.[36] In 1961, the Mississippi Barge Lines and three midwestern railroads reduced rates on grain moving to Gulf Coast ports.[37] The net effect of the rate changes diluted the impact of the seaway.

Besides the freight rate changes limitations in the seaway itself may have offset some of the centralizing tendencies. The limitations on vessel draft through the seaway and Great Lakes connecting channels could have hindered the operation of economies of large scale. Also delays in seaway operation during peak traffic and the seasonal nature of Great Lakes shipping may have deferred some shippers to

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[35] "Railroads Gird for Seaway," Railway Age, March 30, 1959, pp. 9-10.

[36] Changing Shipping Patterns on the St. Lawrence Seaway, op. cit., p. 13.

[37] Ibid., p. 22.

year round rail movement.[38]

In summary, the rank-size hierarchy of Great Lakes ports has not assumed a progressive differentiation and port dominancy relevant in the case of the United States Atlantic Coast nor the general principle advanced for port development. Historical forces of port competition, transport modal duplication, and alternative hinterland outlets were and probably are still determining. Physical limitations of the seaway may also deter the movement toward centralization and dominancy. The changing situation created by the seaway has not, through 1964, imparted general ocean linkage characteristics to the size distribution of Great Lakes ports.

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[38]See Carlos E. Toros and Laurence P. Dowd, The St. Lawrence Seaway: Practical Aspects for Michigan Industry, Michigan Business Report Number 37, Ann Arbor, Michigan: University of Michigan School of Business, 1961, pp. 12-4.

CHAPTER III

CHANGES IN COMMODITY COMPOSITION

In chapter two of this paper attention was directed toward changes in aggregate tonnage and port size distribution as indicative of changes in the volume of port activity. A further important element in the structure of a port's functional character is the composition of the cargo shipped and received. A port may assume a more or less specialized role in spatial linkages depending on the proportions of commodities handled. Concentration on one commodity such as limestone or iron ore can result in maximum port specialization. Conversely, a port handling more nearly equal volumes of a number of different commodities would be less specialized or more diversified in its commodity composition.

The level of specialization or diversification is an indication of the type of spatial linkages served by a port. A hinterland supplying and demanding a significant quantity and variety of goods should require that the servicing port be less specialized. The hinterland may, however, produce or demand a very narrow range of goods requiring a less diversified servicing port. Sufficient extra-local demand may result in a port becoming very specialized in servicing this type of hinterland as it

assembles and ships commodities to demand centers in its foreland.[39]

The character of a port changes coincident with changes in the composition of cargo handled. Significant changes in composition could require extensive modifications in port facilities, labor force requirements, and connecting transportation services. Differences in the character of ports are probably best represented by the composition of commerce rather than absolute variations in tonnage volume.

A review of port-centered research failed to provide an adequate method of gauging changes in commodity composition for individual ports or for comparisons from port to port. Most analyses considered ports individually and measures advanced were of a qualitative measure.[40] Meaningful comparisons of change from port to port and of an individual ports over time clearly called for a quantitative measure of commodity mix. Borrowing methods used by Rodgers[41] in a study of industrial diversification in the United States, an index of commodity specialization-diversification was adopted and altered to provide the

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[39]Hinterland and foreland are used throughout the paper in the context developed by Weigend.

[40]See Richard E. Carter, op. cit. Though Carter develops a classification system based on commodities, the resulting comparisons of ports is not quantitative.

[41]Allan Rodgers, "Some Aspects of Industrial Diversification in the United States," Economic Geography 33:16-30, January, 1957.

quantitative measure required for the study.

Value of United States domestic commerce being unavailable, the index was constructed from commodity tonnage data published by the Army Corps of Engineers.[42] The data provides a three digit commodity classification in nine commodity groups. The groups are highly aggregated, so much so that for purposes of the study the data was recombined into thirteen commodity groups as illustrated in Table V. Because of the absolute level of tonnage volume individual groups were disaggregated from the data groups for grain and soybeans, coal and coke, iron ore and concentrates, and petroleum and products. The thirteen groups were considered the minimum essential number for meaningful comparison. Further insight could be gained by even more detailed disaggregation.

To obtain the index comparison, the actual or cargo tonnages of each commodity group was computed over a three year period, the average reducing the problem of comparing year to year fluctuations and a period brief enough to avoid over-generalization. The commodity groups were then ranked in decending order of tonnages. A percentage of total port tonnage was calculated for each group in a second column. A cumulative total of the commodity group percentages was placed in a third column. The sum obtained from the

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[42] Waterborne Commerce of the United States, Part III, op. cit.

TABLE V

INDEX OF COMMODITY SPECIALIZATION COMMODITY GROUPS

Group number	Commodity group
1.	Animal Products.
2.	Grain and Soybeans.
3.	Other Foods, Beverages, and Non-food Vegetable Products, Except Textile Fibers.
4.	Textile Fibers and Manufactures.
5.	Wood and Paper Products.
6.	Coal and Coke.
7.	Petroleum and Products.
8.	Iron Ore and Concentrates.
9.	Non-metalic Minerals and Related Products.
10.	Metals and Manufactures, Except Machinery and Vehicles.
11.	Machinery and Vehicles.
12.	Chemical Products.
13.	Miscellaneous.[a]

[a]Includes commodities not elsewhere classified, Department of Defense controlled cargoes, shipments of less than one ton, U. S. articles returned, and small amounts of water and ice.

cumulative percentage column was the index number of the port for a given time period, in this case a three year average.

The index number for an individual port provides a measure of the level of specialization or diversification in the commodity mix. With thirteen commodity groups, maximum specialization would yield an index of 1300. The opposite extreme, maximum diversification would result in an index number of 700.

Appendix Tables A-1 through A-18 present the computation form and individual data for each of the ports treated. In addition to providing the index number the method created a data fund for the level of commodities handled by individual ports in two representative periods.

Table VI summarizes changes in commodity composition for the major ports over the study period as well as displaying the relative importance of commodity tonnage. Bulk commodities dominated tonnage totals throughout the study period. Changes however were evident. Iron ore and concentrates, petroleum and products, non-metalic minerals and related products, and machinery and vehicles declined absolutely and relatively in the major ports. Grain and soybeans increased their share by fifty per cent and chemical products increased slightly more than one hundred per cent. Coal and coke increased in importance as did animal products,

TABLE VI

CHANGES IN COMMODITY COMPOSITION FOR THE SEVEN MAJOR GREAT LAKES PORTS BY COMMODITY GROUPS, 1954-56 TO 1962-64
(Thousands of Tons)

Commodity group	1954-56		1962-64	
	Tons	Per cent	Tons	Per cent
1 Animal Products	84	.04	492	.24
2 Grain and Soybeans	8,590	4.04	12,202	6.07
3 Other Foods, Beverages, & Non-Food Vegetable Products	1,140	.54	1,463	.73
4 Textile Fibers and Manufactures	23	.01	29	.01
5 Wood and Paper Products	290	.14	803	.40
6 Coal and Coke	56,848	26.75	61,276	30.49
7 Petroleum and Products	17,867	8.41	14,006	6.97
8 Iron Ore and Concentrates	93,580	44.05	79,745	39.67
9 Non-Metalic Minerals and Related Products	26,998	12.70	24,276	12.08
10 Metals and Manufactures Except Machinery	5,294	2.49	4,564	2.27
11 Machinery and Vehicles	839	.40	419	.21
12 Chemical Products	821	.39	1,665	.83
13 Miscellaneous	89	.04	51	.03
Totals	212,390	100.00	201,050	100.00

Source: Waterborne Commerce of the United States, Part III, Department of the Army, United States Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954.

and wood and paper products.

Based on the commodity grouping as outlined above Table VII lists the index of commodity specialization (or diversification) for four period averages. Ports are ranked by the 1962-64 index number in increasing order of specialization. Calcite, Michigan was included to illustrate an example of a highly specialized port, in this instance nearly 100 per cent of total commerce is made up of one commodity, crushed limestone. The index presentation indicates a striking variation in the commodity mix for the seven major ports. Chicago in the final period was far less specialized than its nearest rival, Buffalo. Toledo, dominated by coal shipments was the most specialized. Cleveland because of heavy imports of iron ore was only slightly less specialized than Toledo.

During the study period the only exchange in rank occurred in the Ports of Chicago and Buffalo, and Duluth-Superior and Cleveland. The general ordering did not change substantially. Taken together there was a slight trend toward less sp e cialization. Individual ports varied widely. The more representative periods on the table are the first and last. 1958 was a year of severe economic recession making the period 1957-59 a marginal period of comparison. The period 1959-61 marks the initial years of seaway operation and could be suspect as far less valid

TABLE VII

INDEX OF COMMODITY SPECIALIZATION FOR THE MAJOR GREAT LAKES PORTS, 1954 TO 1964

	1954-56	1957-59	1959-61	1962-64
Port of Chicago	1133.5	1118.9	1112.1	1104.8
Port of Buffalo	1121.3	1126.3	1131.3	1145.4
Port of Detroit	1171.2	1173.2	1174.7	1183.4
Indiana Harbor	1196.7	1202.1	1204.7	1212.1
Duluth-Superior	1258.9	1251.9	1245.5	1248.3
Cleveland	1250.4	1240.1	1247.8	1256.5
Toledo	1260.9	1262.9	1259.0	1257.8
Calcite, Michigan	1299.2	1299.2	1299.4	1299.4
Seven Major Ports	1182.63	--	--	1170.80

Computed from Waterborne Commerce of the United States, Part III, Department of the Army, United States Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954.

than the later three year average which should reflect a more stable operation.

Contrasting only the first and last period from Table VII the greatest commodity shifts in individual ports occurred in Chicago and Buffalo in opposing directions. Movement toward diversification occurred in Chicago, Duluth-Superior, and Toledo. The remaining ports demonstrated a shift toward more specialized commodity mix.

A Lorenz curve presentation was helpful in visually

comparing shifts in composition. Figures 1 and 2 illustrate the shifts for all seven ports and the ports of Chicago respectively. Displayed in this manner, the shift in all ports is slight while Chicago is very significant. Fairly sophisticated calculus can be employed in at this stage should a test of absolute shift be desired.

Analysis of variance for the data presented in Table VII obtained a statistical significance level of .01 substantiating the validity of the index method of commodity comparison. The significance level is appropriate only in a port to port comparison necessitating a lorenz presentation to depict temporal trends. Rather than stating that Duluth-Superior is a bulk ore and grain port, the index allows comparison of the magnitude of that specialization.

Clearly compositional changes occurred over the study period. Analysis of data that will be presented in a subsequent chapter suggested that the presence of the seaway has certainly assisted in commodity changes. Without exception, the ports moving toward commodity specialization over the study period experienced expanding import flows measured in dollars. Those ports with trends toward diversification experienced the opposite condition of growing export flow. The greater the change in composition, the greater the accompanying change experienced in the import-export ratio of foreign commerce value. The ports of

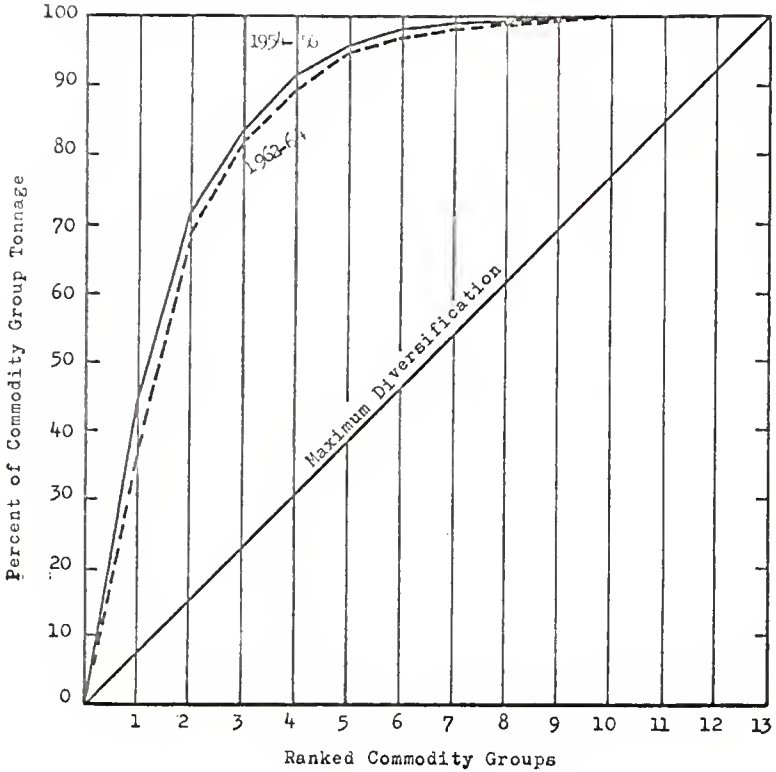

Figure 1

COMMODITY SPECIALIZATION CURVE FOR THE SEVEN MAJOR GREAT LAKE PORTS, 1954 - 56 AND 1962 - 64

Source: Computed from Waterborne Commerce of the United States, Part III, Department of the Army, United States Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual.

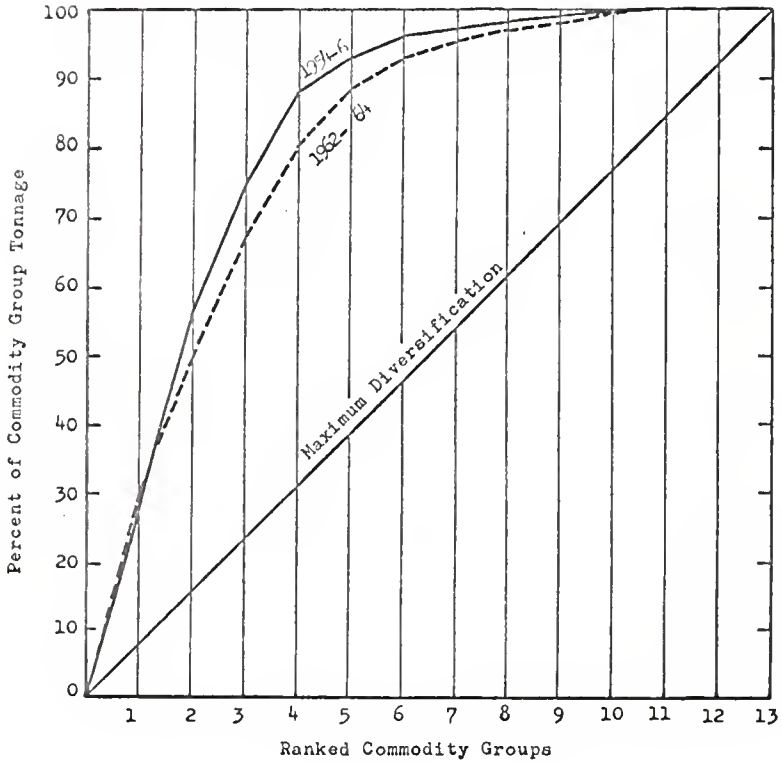

Figure 2

COMMODITY SPECIALIZATION CURVE FOR THE PORT OF CHICAGO, 1954 - 56 AND 1962 - 64

Source: Computed from Waterborne Commerce of the United States, Part III, Department of the Army, United States Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual.

Buffalo, Detroit, Indiana Harbor and Cleveland have become large importers of Labrador iron ore, definitely facilitated by the seaway. At the same time they have failed to generate export tonnages to modify this influence.

Chicago, Duluth-Superior, and Toledo have increased exports absolutely. Grain, particularly, gained in relative importance, reducing the proportion of iron ore and coal. In the case of Chicago, expanding trade of general merchandise as well as grain is reflected in a trend toward specialization.

Completion of the seaway was expected to increase foreign commerce as noted in the impact studies cited earlier. The following chapters will treat that portion of the functional infra-structure of the major ports now that the foundation has been established.

CHAPTER IV

CHANGES IN THE PROPORTIONS OF DOMESTIC AND FOREIGN COMMERCE

Chapters II and III examined changes in the volume of port activity and commodity composition. The discussion was structured to serve as a basis and composite frame of reference for inquiry into spatial linkage changes, a third important element of the total port function. Attention in this section is directed to separating and understanding changes in the spatial extent of commerce served by the major Great Lakes port.

The spatial extent of a port's commerce exchange is a measure of spatial interaction, of a port's response to its geographical situation, as a node servicing commerce transfer. A port may service regional, national or world-wide commerce movement. The relative importance of these linkage categories is represented by the proportion of total commerce devoted to each type of linkage. The port of Calcite, Michigan is a good example of a port with linkages of a regional extent. It ships crushed limestone to consuming points confined to the Great Lakes. No exchange is carried on by Calcite with any point out of the Great Lakes proper. The Port of Buffalo fulfills the same service as Calcite in a much wider range of commerce. In addition it

has historically been a gathering point for grain produced in the heart of North America for transhipment to eastern consumption centers thereby serving the movement of national commerce.[43]

Prior to the altered geographical situation created by the new seaway the Great Lakes were everwhelmingly a system of inland waterways utilized for domestic exchange of American and Canadian commerce. Foreign commerce was significant only between the two nations. Exchange of waterborne commerce beyond a regional level was severely handicapped by the capacity and limitations of the former all-Canadian fourteen-foot seaway.[44] The old waterway was so inadequate that in times of peak traffic a large amount of commerce was forced to use railroad facilities.[45]

Table VIII summarizes the relationship of foreign and domestic commerce for the United States Great Lakes and the Seven major ports in two representative periods. The dominance of domestic commerce is unmistakable in the pre-seaway period. Ninety-two per cent of all U. S. lake commerce was domestic traffic. The seven major ports mirrored

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[43]Joseph R. Hartley, op. cit., p. 234; see also Gunnar Alexandesson, op. cit., p. 261.

[44]Harold M. Mayer, op. cit., pp. 35-7.

[45]Joseph R. Hartley, op. cit., p. 173.

the dominance exactly.

TABLE VIII

CHANGES IN THE RELATIONSHIP OF GREAT LAKES DOMESTIC AND FOREIGN WATERBORNE COMMERCE TONNAGE, 1954-56 TO 1962-64
(Thousands of Tons)

	1954-56		1962-64	
	Tons	Per cent	Tons	Per cent
Total Great Lakes Waterborne Commerce	390,480	100	368,694	100
Total Domestic Commerce	359,385	92	321,626	87
Total Foreign Commerce	31,095	8	47,068	13
Seven Major Great Lake Ports total Commerce	212,390	100	201,048	100
Seven Ports Domestic Commerce	195,974	92	171,030	85
Seven Ports Foreign Commerce	16,516	8	30,018	15

Source: Waterborne Commerce of the United States, Part III, Department of the Army, United States Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954.

The absolute decline in total Great Lakes commerce was noted in Chapter II. Table VIII illustrates that the general decline was confined to domestic traffic. Foreign commerce increased relatively and absolutely during the study period. Total Great Lakes foreign commerce grew

fifty per cent from 1954-56 to 1962-64. The major ports enjoyed an even more dramatic increase of nearly one hundred per cent in the same time interval. Additionally, the seven ports increased their share of total Great Lakes foreign commerce from 53 to 64 per cent indicating concentration of the growing volume.

Increase in foreign commerce was significant through the study interval pointing to a shift in spatial orientation. In the post-seaway period 15 per cent of the major ports' commerce had foreign origins or destinations contrasted with only 8 per cent in the pre-seaway period. Absolute growth was about 14 million tons or about the same magnitude as the total commerce for the Port of Buffalo.

Though the relative shift in commerce orientation was of major proportions domestic traffic continued to overshadow foreign commerce. Figure 3 graphically traces the relationship of domestic and foreign commerce for the seven major ports since 1954. Wide year to year variation characterized total commerce. Foreign commerce avoided erratic change growing steadily over the study span. Clearly, the least stable commerce orientation resided in domestic traffic.

While striking changes occurred in the proportions of domestic and foreign commerce, important differences were evident within domestic traffic explaining the erratic nature of year to year changes. All of the decrease over

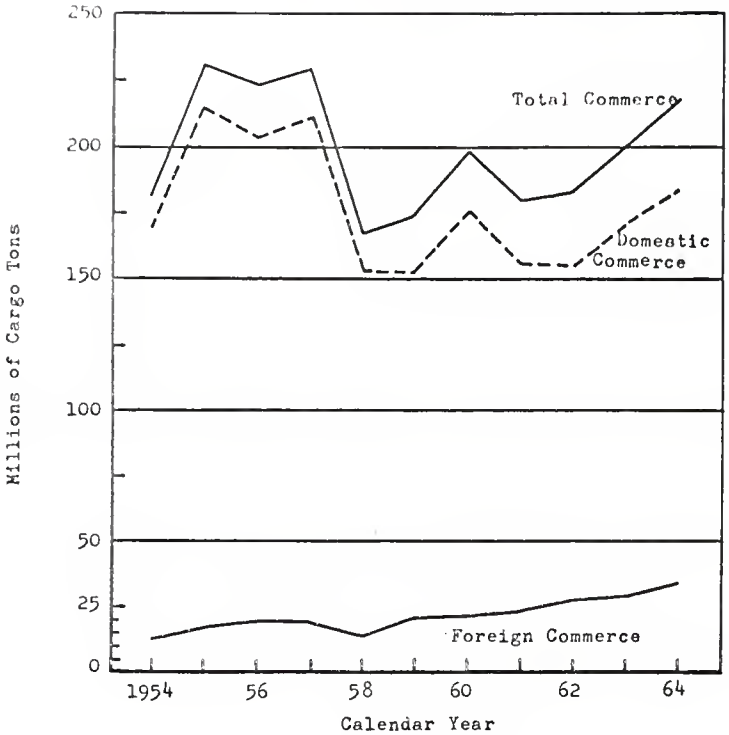

Figure 3

RELATIONSHIP OF DOMESTIC AND FOREIGN WATERBORNE COMMERCE FOR THE SEVEN MAJOR GREAT LAKES PORTS, 1954 - 1964

Source: Waterborne Commerce of the United States, Part III, Department of the Army, United States Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954.

the study period was recorded in lakewise or lake-port-to lake-port movement. Lakewise traffic declined from 168 million tons in 1954-56 to 143 million tons in 1962-64 or more than the 22 million tons decrease in total Great Lakes waterborne commerce.[46] The slip in lakewise traffic was offset by a slight increase in local, internal and coastwise movement.[47]

Interestingly, coastwise commerce or shipments between the seven major ports and other U. S. seacoasts averaged only 127 thousand tons in 1954-56. The restraints imposed by the old seaway system would seem operative in this figure. However in the post-seaway period, 1962-64, coastwise commerce averaged only 226 thousand tons. The percentage increase was quite high though absolute increase was negligible. Evidently land transport modes are competitive in this traffic despite the improved seaway.[48]

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[46] Computed from Waterborne Commerce of the United States, Part III, op. cit.

[47] Local and internal commerce is traffic received or shipped from the port by way of inland waterways. See Ibid., introduction to any annual issue.

[48] See Joseph R. Hartley, op. cit., pp. 180-82.

PORT VARIATION FROM THE AGGREGATE

Domestic-foreign commerce change varied considerably among the seven major ports. Table IX summarizes commerce orientations shifts for the major ports. Without exception the ports matched the Great Lakes trend toward increased foreign commerce. Only Toledo and the Port of Detroit increased absolutely in domestic commerce tonnage. However, in their case and for all other major ports, the share of foreign commerce increased.

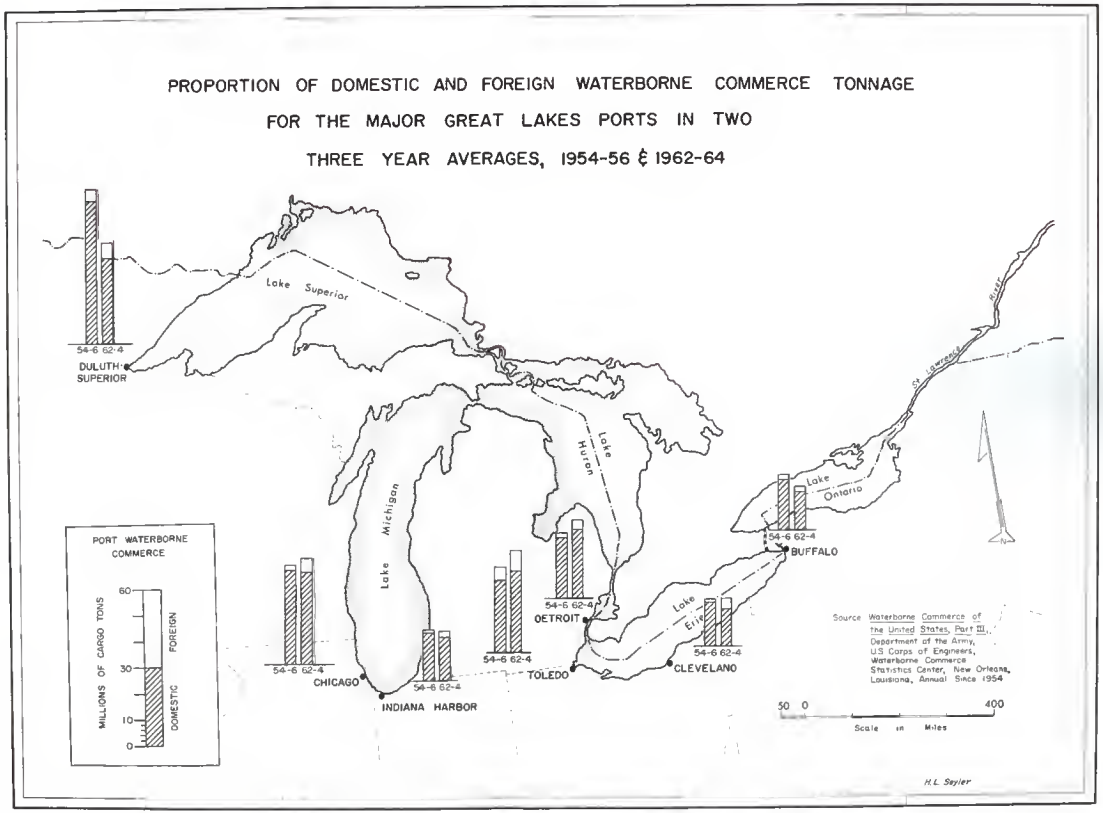
Cleveland led the way with the greatest proportionate shift and is prominent among the major ports in the percentage of foreign commerce in total tonnage. Indiana Harbor, Chicago, and Detroit registered gains of eight, eight, and seven per cent respectively in the proportion of total commerce with foreign orientation. Less marked shifts were recorded for Toledo and Buffalo. Map 2 illustrates the spatial variation in port changes of domestic-foreign commerce mix. A similar pattern is repeated from Map 1 of changes in total commerce. The larger decreases in domestic commerce occurred in ports on the eastern and western extremes of the Great Lakes. Duluth-Superior experienced the largest absolute fall in domestic traffic. Buffalo, most eastern of the major ports exhibited a corresponding loss in domestic tonnage. Increases in domestic commerce

TABLE IX

CHANGES IN THE PROPORTIONS OF DOMESTIC AND FOREIGN WATERBORNE COMMERCE TONNAGES FOR THE SEVEN MAJOR GREAT LAKES PORTS BY THREE YEAR AVERAGES, 1954-56 AND 1962-64
(Thousands of Tons)

	1954-56		1962-64	
	Tons	Per cent	Tons	Per cent
Port of Chicago	37,767		40,350	
Domestic Commerce	35,829	94.9	35,142	87.1
Foreign Commerce	1,938	5.1	5,208	12.9
Duluth-Superior	58,957		38,272	
Domestic Commerce	54,835	93.0	33,442	87.4
Foreign Commerce	4,122	7.0	4,830	12.6
Toledo	33,081		39,469	
Domestic Commerce	27,527	83.2	31,421	79.6
Foreign Commerce	5,554	16.8	8,048	20.4
Port of Detroit	24,279		29,935	
Domestic Commerce	22,970	94.6	26,281	87.8
Foreign Commerce	1,309	5.4	3,654	12.2
Indiana Harbor	19,177		18,671	
Domestic Commerce	18,575	96.9	16,618	89.0
Foreign Commerce	602	3.1	2,053	11.0
Cleveland	17,828		18,074	
Domestic Commerce	16,695	93.6	13,942	77.1
Foreign Commerce	1,133	6.4	4,132	22.9
Port of Buffalo	21,301		16,277	
Domestic Commerce	19,443	91.3	14,184	87.1
Foreign Commerce	1,858	8.7	2,093	12.9

Source: Waterborne Commerce of the United States, Part III, Dept. of the Army, United States Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954.


PROPORTION OF DOMESTIC AND FOREIGN WATERBORNE COMMERCE TONNAGE
FOR THE MAJOR GREAT LAKES PORTS IN TWO
THREE YEAR AVERAGES, 1954-56 & 1962-64
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
St. Lawrence River
54-6 62-4
DULUTH-SUPERIOR
CHICAGO
INDIANA HARBOR
TOLEDO
DETROIT
CLEVELAND
BUFFALO
PORT WATERBORNE COMMERCE
MILLIONS OF CARGO TONS
60
30
10
0
FOREIGN
DOMESTIC
Source Waterborne Commerce of the United States, Part III, Department of the Army, U.S Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954
50 0 400
Scale in Miles
N
H.L. Seyler

MAP 2

were notably restricted to Detroit and Toledo in intermediate positions on the east-west axis of the lakes.

Changes within domestic commerce for the major ports followed the form outlined for all lakes traffic. Lower domestic totals were confined to lakewise commerce. Coastwise traffic gains were evident for Chicago, Toledo, Detroit and Cleveland. Detroit was by far the most important in this respect. However in no instance has coastwise tonnage amounted to even one-half per cent of any of the ports' total commerce.[49]

FACTORS IN PORT CHANGES

In the aggregate, shifts in domestic-foreign commerce orientation were important. Two factors were operative in this change and the new seaway played an essential role in each case. First, there was an absolute decline in domestic commerce. The decrease, however, resulted in an important loss of total commerce for only Duluth-Superior and Buffalo. For Buffalo the decline in domestic commerce occurred because of its geographical situation. Before completion of the new seaway Buffalo was a gathering point for eastward moving lakewise commerce and a western

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[49] Waterborne Commerce of the United States, Part III, op. cit.

terminous for Great Lakes import-bound traffic. The large lake going vessels or "lakers", unable to use the old seaway system, moved cargo to eastern lake ports for transhipment in smaller vessels, called "canallers", or for movement by land modes to the Atlantic coast.[50] Buffalo shared in this linkage organization. The new seaway eliminated the need for the transhipment service provided by Buffalo. Commerce bypassed completely in many instances accounting for Buffalo's actual loss in total commerce. Several of the eastern ports were caught in this position. The Lake Ontario ports of Oswego, Rochester, and Ogdonsburg matched the loss of Buffalo.[51]

Viewed from the vantage point of the other lake ports, much commerce that had been previously classified as domestic traffic, as reflected in port data, became foreign commerce. The measure of spatial linkage orientation changed in this case by being recorded as direct movement made possible by the new seaway in what had previously been hidden by transhipment or bookkeeping myopia. In short, much of the shift toward foreign commerce was not a result

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[50] Harold M. Mayer, op. cit.

[51] See Waterborne Commerce of the United States, Part III, op. cit. See also Donald F. Wood, op. cit., p. 62. Wood quite correctly predicted the seaway impact in the case of Buffalo.

of new commerce but of a different condition of commerce linkage.

The second factor explaining the shift in domestic-foreign commerce orientation involved a real growth in foreign commerce. The bookkeeping changes discussed above accounted for only a portion of the increased foreign commerce orientation. Separation of real growth from bookkeeping growth was not strictly possible because of data limitations. However, some changes were traceable and will be expanded upon in the following chapter.

Changes in the ports of Toledo, Detroit, Chicago, and Indiana Harbor were a result of both factors. Their foreign commerce increased by sharing in the gains represented by the avoidance of cargo transhipment previously classified as domestic. Since these ports were not gathering points for reshipment, they avoided the losses in domestic tonnage incurred by Buffalo. In addition they have enjoyed real growth in foreign commerce in the post-seaway period.

Cleveland is a special case. It was and is not a transhipment port. The loss in domestic commerce and the accompanying increase in foreign tonnage was realized by a change in the source of its principal commodity, iron ore. Ore previously received from domestic lakewise origins has been increasingly supplemented by Labrador iron ore receipts

facilitated by the seaway.[52]

Duluth-Superior is another special case. The influence of the new seaway had only the slightest effect in the decline of domestic commerce. Virtually all of the loss in tonnage was a result of falling ore shipments. Though iron ore shipments still dominate port commerce, the proportion has fallen far below the record level of the early 1950's. In Chapter III the absolute decline in movement of iron ore and concentrates for the major ports was noted. The decrease in Duluth-Superior shipments accounted for more than the total decline. However as Duluth-Superior slipped, newly developed ports at Taconite Harbor and Silver Bay, Minnesota offset the total loss and marked the shift toward beneficiated ores begun in the mid-1950's.[53] The change in Duluth-Superior resulted from declining reserves of good quality Mesabi ore and the turn to beneficiated ore. Change as a result of the seaway was confined to that portion of foreign commerce transiting the seaway previously recorded as domestic, none of which was iron ore.

Changes in the level of foreign commerce and the

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[52]See Waterborne Commerce of the United States, Part III, op. cit. In the latest three year period, 1962-64, nearly 60 per cent of the ore moving into Cleveland originated in Labrador.

[53]See Donald F. Wood, op. cit., p. 65-6. See also Waterborne Commerce of the United States, Part III, op. cit.

nature of spatial linkages is documented in the following section. Aggregate changes in the foreign-domestic mix will be broken down to examine specific changes that can be attributed to conditions created by the new seaway.

CHAPTER V

CHANGES IN FOREIGN COMMERCE AND SPATIAL LINKAGES

The discussion of changes in spatial linkages presented in Chapter IV highlighted the changing relationship of domestic and foreign commerce for the major ports within the total Great Lakes framework. Data was advanced that documented a definite trend toward increasing foreign commerce orientation for all of the major ports in the post seaway period. Domestic commerce changes were explained within the context of changing spatial linkages for all commerce. The following discussion focuses specifically on changes in foreign commerce and the accompanying linkage changes.

THE GREAT LAKES CHANGING POSITION IN THE NATIONAL STRUCTURE

Changes in Great Lakes foreign waterborne commerce since 1959 did not occur in a spatial vacuum. To appreciate the nature and magnitude of changes, to determine trends, the lakes must be considered as part of a much larger national total. Gauging change in the lakes without reference to national change would be as dangerous as examining changes in the output of the automobile industry while

ignoring the general state of the economy.

Table X summarizes the position of the Great Lakes relative to national and areal changes in foreign waterborne commerce tonnage through the study period. A first important observation drawn from the data points out that changes in Great Lakes tonnage occurred during a general expansion in national foreign waterborne commerce. The actual share of the Great Lakes did not increase through the study period. However, in the more representative first and last data intervals Great Lakes tonnage kept pace with the national growth trend.

Figure 4 traces the relationship of Great Lakes and United States foreign waterborne commerce from 1950 to 1964. The graph illustrates a high rate of national increase as tonnage more than doubled during the time interval. Great Lakes commerce displayed a much less uniform pattern through 1958. After 1958 the rate of advance for the Great Lakes has surpassed the national rate. The graph can be misleading in this respect unless the difference in bases is noted. Over the entire study period Great Lakes and national waterborne foreign commerce has increased nearly 70 per cent based on three year averages.

Since value of foreign commerce was available, it was utilized in this chapter for comparison purposes. Table XI summarizes the relationship of Great Lakes and

TABLE X

UNITED STATES WATERBORNE FOREIGN COMMERCE TONNAGE IN THREE YEAR AVERAGES BY COASTAL AREA, 1953-1964
(Thousands of Tons)

Coast	1953-55		1956-58		1959-61		1962-64	
	Tons	Per cent	Tons	Per cent	Tons	Per cent	Tons	Per cent
Atlantic[a]	143,278	62.6	207,000	63.2	185,896	56.9	206,253	53.9
Gulf	36,497	16.0	56,313	17.2	64,272	19.7	81,028	21.2
Pacific[b]	20,721	9.0	32,083	9.8	41,292	12.6	48,433	12.6
Great Lakes	28,317	12.4	31,953	9.8	35,415	10.8	47,068	12.3
Total	228,813	100	327,349	100	326,875	100	382,782	100

[a]Atlantic coast custom district includes Puerto Rico.

[b]Pacific coast custom district includes Alaska and Hawaii.

Source: United States Foreign Waterborne Commerce, Great Lakes Area (Annual Since 1955), United States Bureau of the Census, Foreign Trade Division, Washington, D. C.

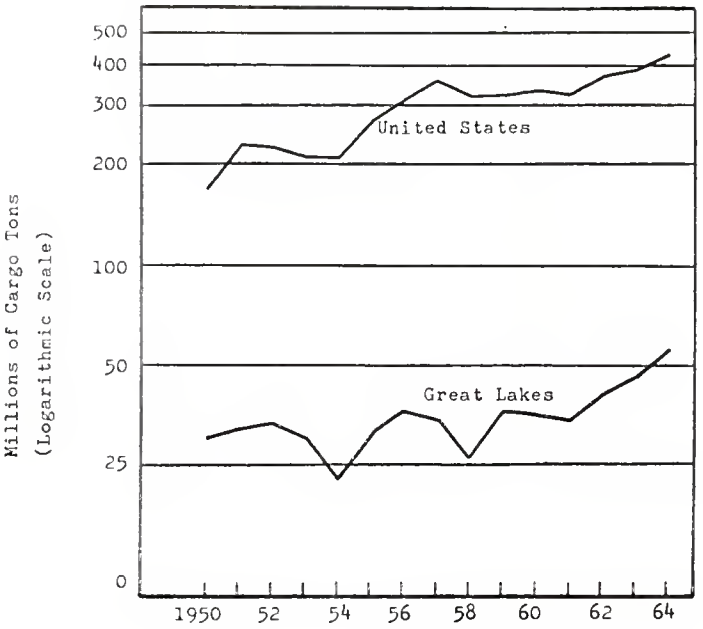

Figure 4

UNITED STATES AND GREAT LAKES FOREIGN WATERBORNE COMMERCE TONNAGE, 1950 - 1964

Source: Waterborne Commerce of the United States, Part III and V, Department of the Army, United States Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954.

TABLE XI

UNITED STATES WATERBORNE FOREIGN COMMERCE VALUE IN THREE YEAR AVERAGES BY COASTAL AREA, 1953-1964
(In Millions of Dollars)

Coast	1953-55		1956-58		1959-61		1962-64	
	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent
Atlantic[a]	11,678	65.9	15,665	66.6	15,250	62.4	17,147	60.1
Gulf	3,283	18.5	4,409	18.7	4,947	20.3	5,960	20.9
Pacific[b]	2,220	12.5	2,743	11.6	3,155	12.9	3,717	13.0
Great Lakes	536	3.0	698	3.0	1,071	4.4	1,696	5.9
Total	17,717	100	23,515	100	24,423	100	28,520	100

[a]Atlantic coast custom district includes Puerto Rico.

[b]Pacific coast custom district includes Alaska and Hawaii.

Source: FT 985; United States Waterborne Foreign Trade (Summary Reports Monthly and Annually), United States Bureau of the Census, Foreign Trade Division, Washington, D. C.

national changes in the value of foreign waterborne commerce. Here, one of the more important changes in Great Lakes post-seaway commerce is noted. Within an expanding national value of foreign commerce the Great Lakes, in the post-seaway period, nearly doubled the share of commerce value. Tables X and XI taken together sketch a meaningful pattern. While maintaining their share of foreign commerce tonnage the Great Lakes increased the value of that commerce, or in short, the Great Lakes ports are handling increasingly more valuable cargo. All Great Lakes foreign cargo averages $19 per ton in 1953-55. By 1962-64 value on a per ton basis increased to $36. This contrasts with a national per ton average of $77 and $74 over the same period.

PORT VARIATIONS IN VOLUME AND DIRECTION OF FOREIGN COMMERCE FLOW

Waterborne foreign commerce value data limits consideration of changes in individual ports to six in the control group. Indiana Harbor is not differentiated in the census value of commerce data.[54] Concentration of foreign commerce tonnage during the post-seaway period for the seven major ports was noted in Chapter IV. Eliminating

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[54]Indiana Harbor falls in the "East Chicago" category which also includes Gary and Buffington Harbor, Indiana.

Indiana Harbor, the remaining six ports averaged 51 per cent of total foreign tonnage in 1953-55 and 59 per cent in 1962-64 or the same general trend toward concentration in a growing volume.

Table XII summarizes the tonnage changes and direction of foreign commerce flow for the six major ports. The general trend of increasing foreign orientation is repeated from Table IX. Breakdown of commerce flow yields some interesting insight into the nature of the expanding foreign orientation. The only port with movement in the direction of a balanced tonnage flow was Chicago. In every other port there was a definite trend toward concentration of tonnage in either imports or exports. In no instance was the direction of flow reversed over the study period.

Map 3 illustrates the spatial variation in foreign commerce tonnage changes. The relationship of imports and exports mirrors the presentation of total commerce flow illustrated in Map 1. In no instance is Map 3 in conflict with Map 1. Shipping and receiving ports in total commerce are repeated in the flow of imports and exports.

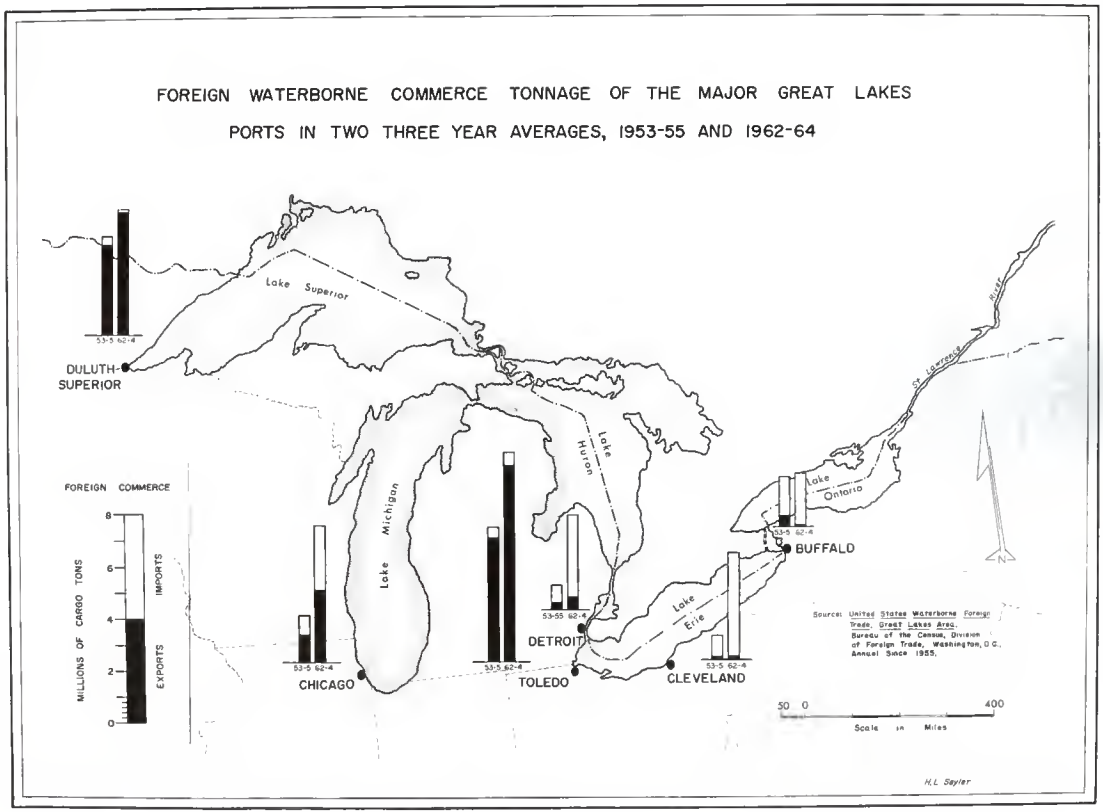
Table XIII summarizes changes in the value of foreign waterborne commerce for the six major ports. Just as concentration of tonnage was noted previously, concentration of commerce value increased in the post-seaway period. The share of the six ports increased from an average of 68 per

TABLE XII

DIRECTION OF FLOW OF WATERBORNE FOREIGN COMMERCE TONNAGE FOR SIX MAJOR GREAT LAKES PORTS IN THREE YEAR AVERAGES, 1953-1964
(Thousands of Tons)

	1953-55	1956-58	1959-61	1962-64
Port of Chicago	1,795	2,083	2,762	5,207
Exports	1,119	1,304	1,485	2,785
Imports	676	779	1,277	2,422
Duluth-Superior	3,809	3,943	4,426	4,830
Exports	3,495	3,704	4,290	4,746
Imports	314	239	136	84
Toledo	5,123	5,804	6,729	8,048
Exports	4,779	5,191	6,052	7,519
Imports	344	613	677	529
Port of Detroit	943	1,719	2,911	3,654
Exports	265	663	686	496
Imports	678	1,056	2,225	3,158
Cleveland	911	1,290	2,900	4,132
Exports	127	118	141	151
Imports	784	1,172	2,759	3,981
Port of Buffalo	1,899	2,033	1,207	2,093
Exports	475	253	205	78
Imports	1,424	1,780	1,002	2,015

Source: United States Waterborne Commerce, Part III (Annual Since 1954), United States Department of the Army, Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana; United Foreign Waterborne Commerce, Great Lakes Area (Annual Since 1955), United States Bureau of the Census, Foreign Trade Division, Washington, D. C.


FOREIGN WATERBORNE COMMERCE TONNAGE OF THE MAJOR GREAT LAKES PORTS IN TWO THREE YEAR AVERAGES, 1953-55 AND 1962-64
Lake Superior
DULUTH-SUPERIOR
Lake Michigan
CHICAGO
Lake Huron
DETROIT
TOLEDO
Lake Erie
CLEVELAND
Lake Ontario
BUFFALO
St. Lawrence River
53-5 62-4
FOREIGN COMMERCE
MILLIONS OF CARGO TONS
IMPORTS
EXPORTS
0
2
4
6
8
N
Source: United States Waterborne Foreign Trade, Great Lakes Area, Bureau of the Census, Division of Foreign Trade, Washington, D.C., Annual Since 1955.
50 0 400
Scale in Miles
H.L. Sayler

MAP 3

TABLE XIII

DIRECTION OF FLOW OF WATERBORNE FOREIGN COMMERCE BY VALUE FOR SIX MAJOR GREAT LAKES PORTS IN THREE YEAR AVERAGES, 1953-1964
(Millions of Dollars)

	1953-55	1956-58	1959-61	1962-64
Port of Chicago	118.7	166.0	311.8	488.0
Exports	51.4	76.6	154.3	267.8
Imports	67.3	89.4	157.5	220.2
Duluth-Superior	45.5	45.2	132.9	198.1
Exports	31.6	36.5	127.0	190.0
Imports	13.9	8.7	5.9	8.1
Toledo	66.1	75.9	132.3	217.3
Exports	60.4	65.6	107.0	177.4
Imports	5.7	10.3	25.3	39.9
Port of Detroit	58.4	79.0	143.8	218.1
Exports	21.9	35.2	67.5	90.7
Imports	36.5	43.8	76.3	127.4
Cleveland	32.7	52.3	94.3	118.1
Exports	14.9	20.7	31.4	36.3
Imports	17.8	31.6	62.9	81.8
Port of Buffalo	43.9	35.5	28.1	34.5
Exports	14.3	7.1	10.1	6.0
Imports	29.6	28.4	18.0	28.5

Source: FT 985 United States Foreign Waterborne Commerce (Annual Summary Report), United States Bureau of the Census, Foreign Trade Division, Washington, D. C.

cent in 1953-55 to 75 per cent in 1962-64. Appendix Table A-XX outlines the changing share of value and tonnage of foreign waterborne commerce for each of the ports individually.

Variations in value changes and direction of value flows are illustrated in Map 4 for the six major ports in two representative periods. The dramatic increase noted for Chicago raises the proposition of port dominancy or primacy in value of foreign commerce. The Port of Chicago alone accounted for over one-third of the total value of Great Lakes foreign commerce in the latest period average, 1962-64. Clearly, the average value of each ton of foreign commerce passing through the Port of Chicago is not approached by any other lakes port.

Contrasting value in Map 4 with tonnage flows in Map 3 demonstrates that levels in one criterion are not always representative of the other. Export and import values show no discernable general principle. Analysis of value trends must include commodity by commodity investigation beyond the scope of this study and would be dependent on data of restricted availability.[55] The increasing

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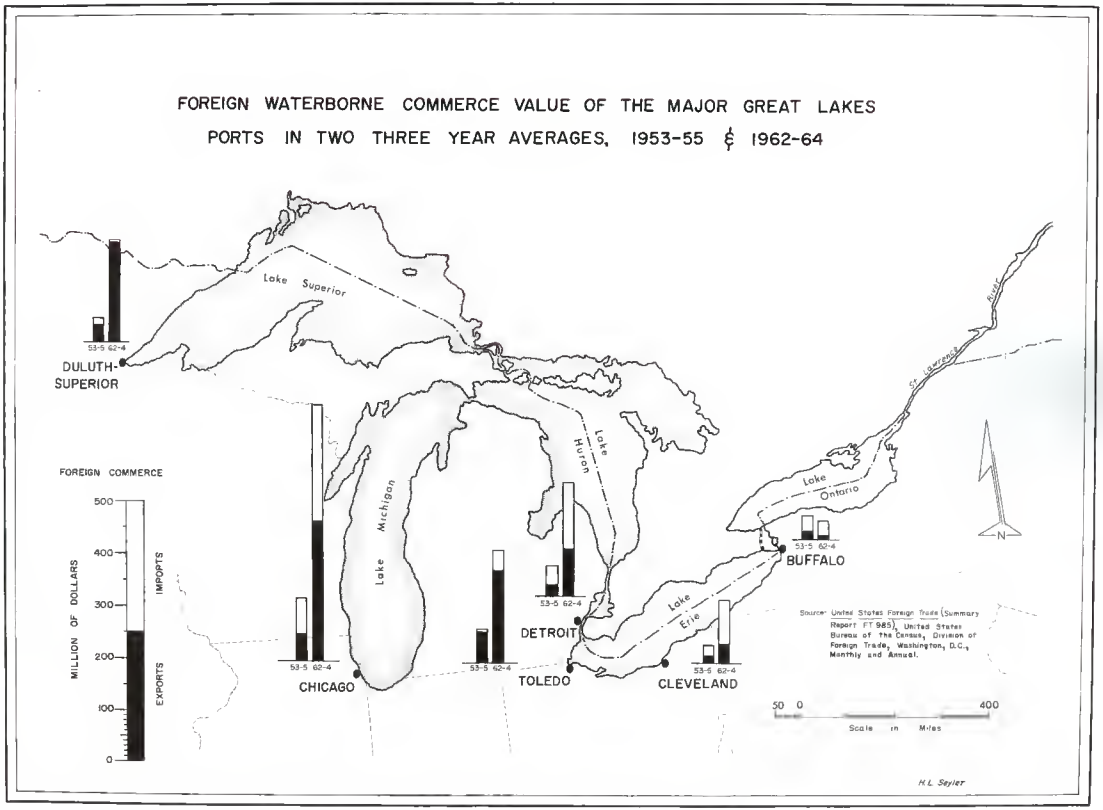
[55]Data on value of shipments by port of origin and destination is available in specially tabulated reports prepared on an individual basis for a nominal fee from the Bureau of the Census, Division of Foreign Trade.


FOREIGN WATERBORNE COMMERCE VALUE OF THE MAJOR GREAT LAKES PORTS IN TWO THREE YEAR AVERAGES, 1953-55 & 1962-64
Lake Superior
DULUTH-SUPERIOR
Lake Michigan
CHICAGO
Lake Huron
DETROIT
TOLEDO
Lake Erie
CLEVELAND
Lake Ontario
BUFFALO
St. Lawrence River
53-5 62-4
FOREIGN COMMERCE
MILLION OF DOLLARS
500
400
300
200
100
0
IMPORTS
EXPORTS
N
Source: United States Foreign Trade (Summary Report FT 985), United States Bureau of the Census, Division of Foreign Trade, Washington, D.C., Monthly and Annual.
50 0 400
Scale in Miles
H.L. Seyler

MAP 4

foreign commerce value is conspicuous for all ports except Buffalo. Conditions discussed in Chapter IV apply here as well. The declining necessity of transhipment serviced by Buffalo brought about by the new seaway is reflected in a lower total value of foreign commerce in the post-seaway level. The more favorable import value level has resulted from the earlier mentioned increase in Labrador iron ore receipts.[56]

Increased export tonnage and value for Duluth-Superior, Toledo, and the Port of Chicago has been partly a result of mounting grain exports. Exports of grain from the three ports increased from 822 thousand tons in 1958 to 5.8 million tons in 1962.[57] The lower shipping costs allowed by the seaway has seen the national share of Great Lakes grain exports rise from 4 per cent in 1958 to 18 per cent in 1962.[58]

The higher totals in import values for Detroit and Cleveland were in part a result of very large imports of Labrador iron ore. Gradually lakewise sources of ore are

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[56] Waterborne Commerce of the United States, Part III, op. cit.

[57] Changing Shipping Patterns on the St. Lawrence Seaway, op. cit., pp. 11-12.

[58] Ibid.

being surplanted with Canadian ore in both ports.[59]

CHANGES IN OVERSEAS COMMERCE

To this point no effort was made to spatially divide foreign commerce exchange. However, consideration of spatial linkages would be incomplete without a degree of differentiation. Historically a large measure of Great Lakes waterborne foreign commerce has been between American and Canadian lake ports. Both the Corps of Engineers and Bureau of the Census data breaks commerce into total and overseas commerce. The latter designation eliminates all exchange with Canada.

There is a certain amount of virtue in this kind of disaggregation, but a problem also. Prior to 1962, the Great Lakes-Canada designation used by the Bureau of the Census included Montreal and all points west. Montreal is located at the upper limit of ocean-shipping penetration of the St. Lawrence Estuary. It can be reached by Great Lakes commerce only by negotiation of the seaway. Therefore, data prior to 1962 included commerce transiting and not transiting the old and new seaway systems in the same category. Some logically consistent data manipulation was and is imperative for meaningful comparisons of Canadian-American

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[59] Waterborne Commerce of the United States, Part III, op. cit.

commerce affected by the improved seaway.

Corps of Engineers data supplies tonnage figures for overseas commerce which eliminates Canadian Exchange. Table XIV summarizes the overseas category of Great Lakes commerce. Post-seaway overseas tonnage literally exploded. The proportion of total Great Lakes commerce involving overseas linkages increased three times over in the first post seaway interval. By 1962-64, the average overseas commerce was 14 per cent of total Great Lakes Foreign Commerce. Meanwhile the share of Great Lakes overseas commerce had increased five times relative to the national total. Since this eliminates all Canadian trade, increased interchange by way of the new seaway is understated.

Figure 5 traces the relationship of Great Lakes total foreign commerce to overseas commerce from 1950 to 1964. The leap of overseas tonnage is more than evident in 1959. The data clearly indicates that an increasing share of Great Lakes and United States Commerce is transiting the new seaway. The spatial extent of Great Lakes commerce is gaining in world-wide orientation.

Appendix Table A-XIX summarizes in detail the changing nature of Great Lakes foreign commerce. Selected years in the pre- and post-seaway study period demonstrate a decided extension of water linkages. The proportion of foreign commerce exchange with Canada lake ports has

declined markedly since 1959. Trade with Atlantic Canada or points east of Montreal has expanded with Labrador iron ore the principal ingredient. Additionally, the Great Lake ports have established commerce linkages since 1959 with areas not previously served, notably the growing trade with Asia.

TABLE XIV

GREAT LAKES OVERSEAS WATERBORNE FOREIGN COMMERCE TONNAGE BY THREE YEAR AVERAGES, 1953-1964[a]
(Thousands of Tons of 2000 lbs.)

	1953-55	1956-58	1959-61	1962-64
Great Lakes Overseas	662	1,360	4,719	6,428
As a per cent of total Great Lakes Foreign Commerce	2.34	4.25	13.33	13.66
As a per cent of total U. S. Foreign Commerce	.28	.42	1.44	1.68

[a]Excludes trade with Canada and includes tonnages shipped via Canada with non-Canadian ports of lading and unlading.

Source: United States Foreign Waterborne Commerce, Great Lakes Area (Annual Since 1955), United States Bureau of the Census, Foreign Trade Division, Washington, D. C.; United States Waterborne Commerce, Part III (Annual Since 1954), Department of the Army, United States Corps of Engineers, Waterborne Commerce Statistical Center, New Orleans, Louisiana.

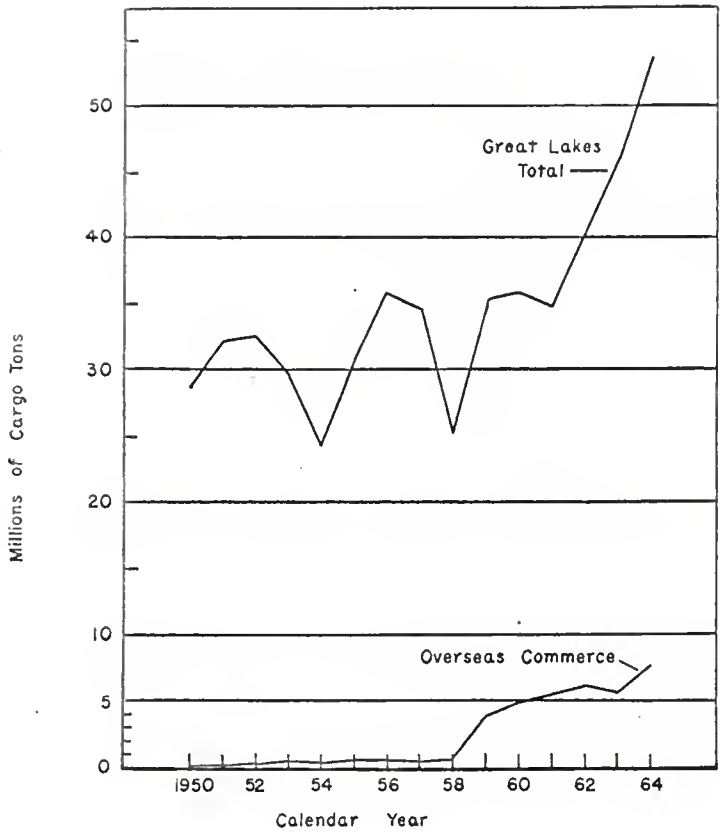

Figure 5

GREAT LAKES FOREIGN WATERBORNE COMMERCE
TONNAGE 1950 - 1964

Source: Waterborne Commerce of the United States, Part III, Department of the Army, United States Corps of Engineers, Waterborne Commorco Statistics Center, New Orleans, Louisiana, Annual Since 1954.

Table XV presents changes in overseas commerce for the six major ports ranked by their 1962-64 average totals. Increases in the individual ports are notable for the time of change registering agreement with Fig. 5. None of the ports experienced overseas commerce of even one per cent of the port total before 1959. Large increases were recorded in the first interval average after 1959 and expansion continued through 1964. Concentration of the increased overseas commerce was striking. In the 1954-56 average, the six major ports accounted for 60 per cent of overseas commerce. By 1962-64, their share increased to 93 per cent or virtually all of the total.

Duluth-Superior stands out conspicuously in overseas linkages. From nothing overseas commerce grew to over 6 per cent of total port tonnage and nearly one-half of an increasing foreign commerce tonnage. Chicago, the most important overseas commerce port before 1959,[60] has increased remarkably but ranks second in tonnage since 1959. Chicago's overseas commerce in the 1962-64 interval averaged an even one-third of total foreign commerce tonnage, second only to Duluth-Superior. Detroit, Cleveland, and Toledo

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[60] See Harold M. Mayer, "Great Lakes Overseas; An Expanding Trade Route," Economic Geography, 30:117-43, April, 1954. Mayer's generally invalid overseas commerce projections were, in all fairness, based on data for only one year.

TABLE XV

OVERSEAS WATERBORNE FOREIGN COMMERCE TONNAGE FOR THE MAJOR GREAT LAKES PORTS BY THREE YEAR AVERAGES, 1954-1964
(Thousands of tons and per cent of total port commerce)

	1954-1956		1956-1958		1959-1961		1962-1964	
	Tons	Per cent	Tons	Per cent	Tons	Per cent	Tons	Per cent
Duluth-Superior	6	.01	11	.02	1,833	5.21	2,354	6.15
Port of Chicago	206	.54	254	.62	1,013	2.64	1,687	4.18
Port of Detroit	82	.34	84	.33	523	2.00	709	2.37
Toledo	34	.10	26	.08	202	.60	669	1.69
Cleveland	49	.27	58	.36	212	1.34	414	2.29
Port of Buffalo	7	.03	10	.04	123	.75	162	.99

Source: Waterborne Commerce of the United States, Part III, Department of the Army, U. S. Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954.

averaged 19, 10, and 8 per cent respectively of overseas commerces as a proportion of total foreign commerce in 1962-64. Exchange with Canada continues to dominate their foreign commerce with heavy coal exports from Toledo and iron ore imports from Labrador to the other three.

Value of overseas commerce was not differentiated from total foreign commerce for comparison. However, based on data presented in Table XII, a reasoned estimate would result in a different rank ordering from tonnage figures. No doubt, Chicago would lead in value of commerce despite the larger tonnages of Duluth-Superior.

SEAWAY TRAFFIC OF THE MAJOR PORTS

The mounting volume of overseas commerce for the major port and the high level of traffic concentration evidenced a major shift in water linkage orientation. The historical dominance of Great Lakes-Canadian foreign commerce has begun to diminish in the major ports. The nature of data presented tends to hide even greater change within American-Canadian exchange which also signifies an important shift in linkages. Table XVI summarizes St. Lawrence Seaway traffic for the major ports in selected years. The implication of masked linkage change in Canadian-American commerce is substantiated by comparison of actual seaway tonnages with overseas commerce. The difference in seaway

TABLE XVI

ST. LAWRENCE SEAWAY TRAFFIC OF THE SIX MAJOR GREAT LAKES PORTS IN SELECTED YEARS, 1959-1963[a]
(Thousands of Tons)

	1959	1960	1962	1963
Chicago	2,209	1,989	2,788	4,248
Duluth-Superior	2,533	3,931	3,215	3,590
Toledo	1,852	2,041	4,651	3,973
Detroit	1,297	1,743	2,049	2,068
Cleveland	1,712	1,908	3,265	3,721
Buffalo	915	802	1,087	1,389
Total, Six Major Ports	10,518	12,414	17,055	18,989
All other U. S. Ports	10,614	10,499	11,056	12,864
Total, All U. S. Ports	21,132	22,913	28,111	31,853
Six Major Ports As per cent of total U. S.	49.8	54.2	60.7	59.6
Total Seaway Tonnage	27,156	33,707	39,646	45,570
Six Major Ports As a per cent of Seaway Total	38.7	36.8	43	41.7

[a]Represents combined traffic report for Montreal-Lake Ontario section and Welland Canal, eliminating all duplication.

Source: Traffic Report of the St. Lawrence Seaway (Annual Since 1959); prepared jointly by the St. Lawrence Seaway Authority, and The Saint Lawrence Seaway Development Corporation, Massena, New York.

and overseas totals marks expanding exchange with Atlantic Canada.[61]

The six major ports dominate American tonnage flows through the new seaway. They consistently accounted for over one-half of the total United States seaway tonnage and 40 per cent of a growing seaway total tonnage.[62] Additionally, the 1963 traffic volume registered by the major ports represented 45 per cent of total Great Lakes foreign commerce.

Trends reflected by commerce data are unmistakable. Great Lakes waterborne foreign trade has increased over the study period. The increase has kept pace with a growing national volume. By value, Great Lakes foreign commerce has increased relative to the national total. More important to this study, the orientation of commerce linkages have demonstrated a remarkable change in the post seaway period as verified by overseas commerce expansion and increased seaway traffic. A summary and conclusion of changes in

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[61]Prior to 1962 the area designation included all points east of Montreal. Since 1962 Montreal is included in Atlantic Canada. See United States Foreign Waterborne Commerce, Great Lakes Areas, 1962, United States Bureau of the Census, Foreign Trade Division, Washington, D. C., Annual Since 1955.

[62]In 1965, the six major port accounted for 51 per cent of U. S. seaway traffic and 39 per cent of a record seaway tonnage. See Traffic Report of the St. Lawrence Seaway, 1965, the St. Lawrence Seaway Authority and the St. Lawrence Seaway Development Corporation, Massena, New York.

spatial linkages is presented in the following section.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Completion of the new St. Lawrence Seaway was expected to change the orientation of Great Lakes water linkages. Projected seaway tonnage levels of 60 million tons annually by 1970[63] anticipated enlargement of spatial linkages for Canadian and American lake ports. Predicted expansion was based upon the wealth of potential traffic originating from the extensive and highly productive hinterland of the lake ports.[64] With completion of the new seaway the major Great Lakes ports were assumed to have a definite advantage in servicing the central interior of North America. Exploitation of the advantage, or improved geographical situation, was expected to result in an increased direct foreign exchange of waterborne commerce which had previously been directed through coastal ports.[65] The proposition was advanced that the lower costs of all water movement made possible by the seaway would generate new

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[63] Donald F. Wood, op. cit., p. 65.

[64] See Joseph R. Hartley, op. cit., p. 42.

[65] Edwin H. Draine, Import Traffic of Chicago and Its Hinterland, Department of Geography Research Paper Number 81, Chicago: University of Chicago Department of Geography, 1963, p. 26.

traffic and as a result stimulate industrial production, which would in turn originate still more traffic. The Great Lakes were projected as North America's "fourth seacoast" as ocean shipping would follow a general principle of maximum possible inland penetration.[66]

Estimates of seaway traffic advanced in the planning and construction stages varied widely. Official St. Lawrence Seaway Development Corporation estimates predicted tonnage levels of 25 million tons in 1959, 37 million tons in 1962, and 48 million tons by 1966.[67] Preliminary figures released by the Development Corporation placed actual 1966 traffic at 49.2 million tons--the first year in which tonnage has exceeded the original estimates.[68]

Actual cargo transiting the seaway over the study period grew from 20.4 million tons in 1959 to 25.6 in 1962 and 39.3 in 1964.[69] This contrasts with a peak tonnage of 13.5 million tons for the old seaway system in 1956.[70] The

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[66]Donald F. Wood, op. cit., p. 61.

[67]St. Lawrence Seaway Development Corporation, Annual Report, 1964, op. cit.

[68]Seaway Tonnage Sets New Record, News Release, Massena, New York, The St. Lawrence Seaway Development Corporation, January 3, 1967.

[69]Traffic Report of the St. Lawrence Seaway, op. cit. Totals were calculated from annual reports.

[70]Changing Shipping Patterns on the St. Lawrence Seaway, op. cit., p. 4.

proportion of seaway traffic with origins or destinations in United States Great Lakes ports has on the average comprised over 60 per cent of total tonnage.[71] The meaning in the data is obvious. Since the new seaway opened Great Lakes commerce increased in spatial extent creating a new linkage environment.

Changes in the structure of Great Lakes port functions in the post-seaway environment were discussed and documented in preceding sections. The presentation drew heavily on data analysis for trend illumination. A brief summary of the important changes noted follows below.

SUMMARY OF PORT CHANGES

The problem investigated in this study focused on change in the major United States Great Lakes ports. The central question concerned functional change resulting from a change in geographical situation or spatial reorientation in water linkages--in this instance completion of the new St. Lawrence Seaway. To understand changes the principal ports servicing these water linkages were examined by subdividing the primary function into constituent elements. The more important elements investigated were changes in port activity as measured by volume of commerce interchange,

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[71] Computed from St. Lawrence Seaway Development Corporation Annual Report (1959-1964), op. cit.

changes in the composition of commerce exchange, and changes in spatial linkages of commerce exchange.

Anticipated change centered on the nature of spatial linkages responding to the altered geographical situation. However, to provide a framework for comparison and data control of the total or aggregate structure of the major ports and Great Lakes commerce were examined in Chapters II and III. Data grouped in pre- and post-seaway intervals revealed that major change had not occurred in the movement of total Great Lakes commerce. A slight decline recorded in total commerce tonnage did not alter the aggregate character significantly. Direction of commerce flow was maintained over the study period in each port. Dominant shipping ports remained shipping ports and ports with a receiving dominance continued that orientation. Actual total tonnage declines were confined to Duluth-Superior and Buffalo.

An analysis of rank-size hierarchy was inconclusive. The Great Lakes Ports have developed an unusual hierarchy since 1959. Three of the major ports handled nearly the same tonnage in the latest data period, Chicago, Duluth-Superior, and Toledo. The hierarchy displayed a trend toward concentration of port size at a high mid-range in sharp contrast to the Atlantic Coast. The general principle of a progressive ranking and dominancy was not in

evidence.

Changes in the composition of commodity flows investigated in Chapter III indicated a slight trend toward commodity diversification in total commerce for the seven major ports. Greater shifts toward diversification were experienced in ports with expanding export values. The opposite trend corresponded with accelerating values for imports. Chicago recorded the greatest shift toward diversification while dominating Great Lakes ports in the value of exports. Buffalo registered the greatest shift toward specialization of commodity mix in an environment of falling export value and increased importation of Canadian iron ore. Generally, those ports with a trend toward specialization were involved in heavy receipts of Labrador iron ore without offsetting export tonnage.

After constructing the reference framework of port volume and commodity composition, Chapters IV and V were directed to changes in spatial orientation of water linkages. Chapter IV separated spatial linkages of commerce exchange by spatial extent or areas served. Attention was directed to tracing the changing relationship of domestic and foreign commerce. Data presented indicated a substantial change in commerce orientation. The historical dominance of domestic commerce in the Great Lakes and the major servicing ports diminished considerably in the post-seaway

period. Two factors were advanced in explanation. First, the completion of the new seaway allowed direct exchange of foreign commerce previously classified as domestic because of the nature of its movement. Elimination of transhipment required for pre-seaway movement resulted in bookkeeping growth of foreign commerce offset by a comparable decline in domestic commerce. Real growth of foreign commerce exchange also accounted for a large measure of the ports growing orientation in that direction.

Ports most affected by changes in the domestic-foreign commerce adjustment were ports at the extreme margins of the Great Lakes east-west axis. Buffalo had the greatest redistribution of commerce orientation as a result of declining transhipment of commerce. Seaway improvement eliminated the costly break-of-bulk at eastern lake terminals. Traffic simply bypassed Buffalo.

Change within domestic commerce was confined to a slightly lower total of lakewise traffic. Duluth-Superior registered the largest loss because of decreased shipments of iron ore.

Surprisingly, coastwise commerce increased very little in the post seaway period. Exchange of commerce between Great Lakes ports and the other coasts was and remains negligible.

The general trend in the direction of foreign

commerce linkages was explored in Chapter V. Evidence was conclusive that a very significant change in foreign commerce orientation has occurred. Foreign commerce orientation increased in all of the principal ports. The shift in commerce orientation has taken place within a general upturn in national foreign commerce. The Great Lakes matched the national increase through the study period. The major port increased their relative position as more of the total Great Lakes foreign commerce became concentrated.

In value of foreign commerce, the Great Lakes improved substantially, nearly doubling relative to national totals. Again, concentration of foreign commerce value resulted in an even greater relative gain for the principal ports. They now handle more tonnage and more valuable tonnage than in the pre-seaway period.

The shift in overseas commerce orientation has been remarkable since 1959. Overseas commerce, previously restricted by the old seaway system limitation, advanced dramatically. Exchange has developed with areas not previously served. Nearly all of this expansion was confined to the six principal ports.

Seaway tonnages recorded for the major ports reflected the changes in spatial linkages. The six major ports have consistently handled 40 per cent of the growing seaway traffic. Increased exchange with eastern Canada

comprised another post-seaway linkage expansion.

CONCLUSIONS

Changes in Great Lakes water linkages and resulting functional changes in the major ports documented above could be approached in a cause and effect explanation applied to individual ports within aggregate Great Lakes change. A forceful argument could be constructed by concentrating on the very apparent shifts in a number of criteria in the immediate post-seaway environment. Opposing themes, that the changes might have occurred without seaway development, could be countered by noting that the magnitude of shifts suggests a very real revolution in linkages. Comparisons drawn with national trends would demonstrate that the major ports gained relative to the nation in commerce orientation changes.

A more reasonable approach was to consider change in a less rigid manner. The altered geographical situation in Great Lakes water linkages has resulted in functional change for the ports. A measure of these functional changes, however, cannot be attributed directly to the seaway's completion. The improved waterway linkage served to accelerate and reorient change as well as initiate change. The principal ports were active, if not thriving, functional nodes servicing over one-half of total Great Lakes commerce long

before 1959. Conditions of spatial interaction did not originate with the seaway.

In the post-seaway period the major ports have changed from functioning nodes of regional orientation to increasing world-wide orientation. The reorientation was possible because the new seaway made the principle of complementarity more operative regarding water linkages.[72] Reduction, if not elimination, of intervening linkage opportunity offered by coastal ports resulted in direct lake port and foreign port exchange.[73] The basis for change hinged on one factor--the cost of exchange or the third ingredient for spatial interaction, transferability.[74] Supply and demand conditions in Great Lakes hinterlands and forelands originated exchange. The lower cost of linkage via the seaway attracted traffic in increasing volume that had previously moved in alternative channels. The increased traffic flow was reflected in the servicing ports, substantially changing their functional structure.

In the pre-seaway period commerce exchange between

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[72]Edward L. Ullman, "The Role of Transportation and the Bases for Interaction," Man's Role in Changing the Face of the Earth, edited by William Thomas, Chicago: The University of Chicago Press, 1955, pp. 867-871.

[73]Ibid., p. 868.

[74]Ibid., pp. 868, 871.

Great Lakes area points and foreign ports was realized in four import linkages. Commerce could move entirely by rail to and from a coastal port. It could move via the Mississippi River system to a Gulf Coast port. It could move by combined rail and water through the Great Lakes to the Atlantic Coast; or by combined Great Lakes and the old seaway system. In each of the alternative, at least one costly transhipment of cargo was necessary.

Assuming conditions of complementarity and intervening opportunity were resolved, the cost of transfer determined the selection among the alternatives. Completion of the new seaway altered this situation creating a new linkage possibility. The relative position of commerce originating and receiving points was changed. The interplay of competition between linkage alternatives has resulted in increasing traffic for the major ports. Reorientation of commerce followed the lower cost of all water movement and elimination or reduction of expensive transhipment.[75]

While favorable conditions of transferability were operative in generating increased foreign commerce for the

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[75]See Joseph R. Hartley, op. cit., pp. 175-9. Hartley advanced the proposition that if rail rates were reduced to zero between eastern lake terminals and the Atlantic Coast on grain shipments, the seaway would be competitive because of the high cost of transhipment.

Great Lakes, the same interplay of relative position occurred between the principal lake ports. The nature of port-to-port competition, however was less involved with cost. Once a vessel passed into Lake Erie the cost of moving to one port over another was slight. The critical factor depended on the relative advantage accruing to each port in terms of hinterland accessibility and traffic generation.

Chicago recorded the greatest positive change in the post seaway environment. It registered the largest gains in value of foreign commerce, had the most balanced flow, and handled a wider range of commodity tonnage. Historically Chicago has enjoyed superb interior transportation connections. The position was enhanced by the new seaway generating positive functional change. None of the other major ports can match the concentration of railroad, highways, pipelines, and inland waterways for hinterland service.

Buffalo registered the only negative response among the major ports in the post-seaway environment. Spatial linkage reorientation left Buffalo at a relative disadvantage compared to the other ports. It had previously functioned as a transhipment terminal for Great Lakes commerce. Completion of the seaway severely curtailed the need for the costly service resulting in an absolute commerce decline, lowered foreign commerce value, and a more narrow

range of tonnage composition.

Duluth-Superior has reduced its function as a domestic ore shipping port while increasing its orientation toward foreign commerce. It has increased in value and tonnage of foreign commerce and in the range of tonnage composition. The enlarged post-seaway function placed Duluth-Superior as the leading Grain exporting Great Lakes port.

Toledo has changed least among the major port in the post-seaway period. Increased exports of grain have offset slightly the dominance of coal shipments. Export of coal to Canada remains the chief element in foreign commerce. However, the seaway has facilitated an enlarged linkage with Eastern Canada, and a small shift toward a greater mix in tonnage composition.

Detroit did not share in changes analogous to the other principal ports. It has profited from the seaway despite a restricted hinterland.[76] Detroit was and is not a gathering point for the transhipment of foods or raw materials, therefore, it was not in competition with the remaining ports for that type of cargo. Acquisition of raw materials for local consumption has changed in the post-seaway period. Direct shipment facilitated by the seaway has seen increasing orientation toward foreign commerce

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[76]See Carlos E. Toros and Laurence P. Dowd, op. cit., pp. 51-62.

acquisition of these raw materials. Import values have increased very rapidly along with growing commodity tonnage specialization. Commerce flow has become increasingly one-sided as export tonnages fail to respond accordingly.

Cleveland demonstrated the greatest shift toward foreign orientation of commerce tonnage. Heavy receipts of Labrador iron ore dominated foreign commerce. Imports of additional raw materials for hinterland consumption has led to a very narrow range of tonnage composition with a one-sided import flow. Cleveland has not competed successfully with its larger rivals in increasing export traffic.

The major ports are still dominated by domestic exchange, but the trend is clearly toward more foreign orientation. The rank-size distributional anomaly probably reflects the domination of regional linkages. The ports remain primarily terminals for regional interaction and a more definite rank-size hierarchy should emerge as foreign commerce linkages gradually favor fewer of the larger ports.

A LOOK INTO THE FUTURE

Change over time is a built-in component of geographical analysis. Investigations of spatial variations inevitably includes change. Historical perspective has become an essential element of explanation in virtually all

geographical literature. Analysis of functional change in the major Great Lakes ports after an altered geographical situation has temporal change explicit in the title.

The new seaway should be appraised as only the most recent step in a sequence of changes in Great Lakes water linkages. No doubt, additional improvement will be repeated periodically. The concept of geographical situation refers to relative position spatially at a given time under given conditions. New improvements on the seaway would, again, change the situation of ports servicing the area.

Estimates of the new seaway's capacity hinge on the limitations of the Welland Canal. Three of the eight locks are single and have, in the past, created bottlenecks in times of peak traffic. The projected 60 million tons capacity of the canal will be reached by 1970. That portion of the seaway is certain to receive improvement.

A reasoned estimate of potential seaway traffic would foresee improvement throughout the system and ultimately to deepening and double locking for the entire waterway. Increased size in ships and associated economies of operation will force the issue.

All of this assumes a significant increase in Great Lakes foreign commerce. Several factors reinforce that assumption. The size and productivity of the Great Lakes port hinterlands will continually raise the demand for

increased commerce exchange. The absolute increase in population, production, and affluency will consume ever greater quantities of virtually every commodity. The Great Lakes area steel industry will increase its consumption of Labrador iron ore well above the 13 million tons of 1965. Grain exports will continue to rise, perhaps doubling by the end of the century as the United States endeavors to aid food-deficit areas. Increased levels of commerce exchange will demand minimum cost movement. Changes resulting from the 1959 seaway will be a reminder and model (good or bad) for future development.

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APPENDIX

TABLE A-I

SEVEN MAJOR GREAT LAKES PORTS INDEX OF SPECIALIZATION-DIVERSIFICATION, 1954-56 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
8	93,580,400	44.05	44.05
6	56,847,800	26.75	70.80
9	26,998,300	12.70	83.50
7	17,867,300	8.41	91.91
2	8,589,800	4.04	95.95
10	5,294,100	2.49	98.44
3	1,139,800	.54	98.98
11	839,500	.40	99.38
12	821,400	.39	99.77
5	289,500	.14	99.91
13	89,400	.04	99.95
1	83,600	.04	99.99
4	23,200	.01	100.00
Totals	212,390,000	100.00	1182.63

TABLE A-II

SEVEN MAJOR GREAT LAKES PORTS INDEX OF SPECIALIZATION-DIVERSIFICATION, 1962-64 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
8	79,744,900	39.67	39.67
6	61,276,200	30.49	70.16
9	24,276,100	12.08	82.24
7	14,005,500	6.97	89.21
2	12,202,100	6.07	95.28
10	4,564,100	2.27	97.55
12	1,664,600	.83	98.38
3	1,462,600	.73	99.11
5	803,000	.40	99.51
1	491,600	.24	99.75
11	418,700	.21	99.96
13	51,400	.03	99.99
4	29,000	.01	100.00
Totals	201,050,000	100.00	1170.81

TABLE A-III

PORT OF CHICAGO INDEX OF SPECIALIZATION-DIVERSIFICATION, 1954-56 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
6	10,977,360	29.067	29.067
8	9,816,100	25.992	55.059
9	7,597,970	20.118	75.177
7	5,024,450	13.304	88.481
2	1,871,320	4.955	93.436
10	1,125,570	2.980	96.416
12	526,200	1.393	97.809
5	348,560	.923	98.732
3	343,830	.910	99.642
1	61,780	.164	99.806
13	34,130	.090	99.896
4	20,100	.053	99.949
11	19,080	.051	100.000
Totals	37,766,450	100.000	1,133.470

TABLE A-IV

PORT OF CHICAGO INDEX OF SPECIALIZATION-DIVERSIFICATION, 1962-64 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
6	12,420,400	30.779	30.779
8	7,888,900	19.550	50.329
9	6,804,900	16.863	67.192
7	5,325,800	13.198	80.390
2	3,794,280	9.403	89.793
10	1,504,000	3.725	93.518
12	1,028,900	2.550	96.068
3	801,300	1.986	98.054
5	382,800	.949	99.003
1	305,200	.756	99.759
11	63,200	.156	99.915
4	17,200	.043	99.958
13	16,800	.042	100.000
Totals	40,353,400	100.000	1,104.758

TABLE A-V

DULUTH-SUPERIOR INDEX OF SPECIALIZATION-DIVERSIFICATION, 1954-56 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
8	47,428,950	80.447	80.447
6	5,194,580	8.811	89.258
2	3,233,050	5.484	94.742
9	1,198,600	2.033	96.775
7	1,057,360	1.793	98.568
10	415,810	.705	99.273
3	384,460	.652	99.925
11	34,690	.059	99.984
5	4,320	.007	99.991
12	3,390	.006	99.997
4	1,090	.002	99.999
1	660	.001	100.000
13	0	.000	100.000
Totals	58,956,960	100.000	1,258.959

TABLE A-VI

DULUTH-SUPERIOR INDEX OF SPECIALIZATION-DIVERSIFICATION, 1962-64 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
8	28,681,900	74.942	74.942
2	4,275,900	11.172	86.114
6	2,980,000	7.786	93.900
9	1,199,400	3.134	97.034
10	346,900	.906	97.940
3	346,200	.905	98.845
7	323,300	.845	99.690
1	95,400	.250	99.937
12	11,300	.030	99.967
5	7,800	.021	99.988
4	1,800	.005	99.993
11	1,400	.004	99.997
13	1,000	.003	100.000
Totals	38,272,300	100.000	1,248.347

TABLE A-VII

TOLEDO INDEX OF SPECIALIZATION-DIVERSIFICATION, 1954-56 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
6	24,935,440	76.143	76.143
8	4,602,740	14.055	90.198
7	2,077,780	6.345	96.543
9	768,140	2.346	98.889
2	192,140	.587	99.476
10	104,280	.319	99.795
13	39,100	.119	99.914
3	16,560	.051	99.965
11	5,360	.016	99.981
12	4,350	.013	99.994
1	1,050	.003	99.997
5	1,030	.003	100.000
4	50	0	100.000
Totals	32,748,000	100.000	1,260.895

TABLE A-VIII

TOLEDO INDEX OF SPECIALIZATION-DIVERSIFICATION, 1962-64 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
6	31,007,500	78.563	78.563
8	4,542,800	11.510	90.073
2	1,683,200	4.265	94.338
7	1,232,300	3.122	97.460
9	586,300	1.485	98.945
12	143,500	.364	99.309
3	97,700	.247	99.556
10	86,900	.220	99.776
11	35,100	.089	99.865
5	30,500	.077	99.942
13	15,700	.040	99.982
1	5,500	.014	99.996
4	1,500	.004	100.000
Totals	39,468,500	100.000	1,257.805

TABLE A-IX

PORT OF DETROIT INDEX OF SPECIALIZATION-DIVERSIFICATION, 1954-56 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
6	9,291,000	37.245	37.245
9	6,842,900	27.431	64.676
8	5,183,000	20.777	85.453
10	1,456,900	5.840	91.293
7	1,291,400	5.177	96.470
11	396,500	1.589	98.059
5	202,500	.812	98.871
12	144,300	.578	99.449
2	93,100	.373	99.822
3	27,500	.110	99.932
1	9,600	.038	99.970
13	5,900	.024	99.994
4	1,400	.006	100.000
Totals	24,946,000	100.000	1,171.234

TABLE A-X

PORT OF DETROIT INDEX OF SPECIALIZATION-DIVERSIFICATION, 1962-64 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
6	10,994,300	36.728	36.728
8	9,613,400	32.115	68.843
9	6,592,700	22.024	90.867
10	1,140,200	3.809	94.676
7	757,700	2.531	97.207
12	229,300	.766	97.973
5	197,500	.660	98.633
11	178,900	.598	99.231
2	87,700	.293	99.524
3	69,000	.230	99.754
1	54,400	.182	99.936
13	13,000	.043	99.979
4	6,200	.021	100.000
Totals	29,934,300	100.000	1,183.351

TABLE A-XI

INDIANA HARBOR INDEX OF SPECIALIZATION-DIVERSIFICATION, 1954-56 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
8	7,221,700	37.658	37.658
7	6,672,400	34.973	72.451
9	2,852,700	14.875	87.326
6	2,291,500	11.949	99.275
10	135,600	.707	99.982
12	3,300	.017	99.999
13	200	.001	100.000
1	0	0	100.000
2	0	0	100.000
3	0	0	100.000
4	0	0	100.000
5	0	0	100.000
11	0	0	100.000
Totals	19,177,400	100.000	1,196.691

TABLE A-XII

INDIANA HARBOR INDEX OF SPECIALIZATION-DIVERSIFICATION, 1962-64 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
8	9,034,300	48.387	48.387
7	5,296,300	28.367	76.754
9	2,289,000	12.260	89.014
6	1,694,400	9.075	98.089
10	334,100	1.790	99.879
12	22,000	.113	99.992
1	600	.003	99.995
3	400	.002	99.997
11	50	0	100.000
2	0	0	100.000
4	0	0	100.000
5	0	0	100.000
13	0	0	100.000
Totals	18,671,000	100.000	1,212.107

TABLE A-XIII

CLEVELAND INDEX OF SPECIALIZATION-DIVERSIFICATION, 1954-56 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
8	12,815,800	71.866	71.866
9	3,424,350	19.202	91.068
7	753,650	4.226	95.294
10	303,100	1.700	96.994
6	184,950	1.037	98.031
11	147,700	.828	98.859
3	58,200	.326	99.185
5	53,550	.300	99.485
2	44,300	.248	99.733
12	33,850	.191	99.924
1	10,300	.058	99.982
13	2,600	.015	99.997
4	600	.003	100.000
Totals	17,832,940	100.000	1,250.418

TABLE A-XIV

CLEVELAND INDEX OF SPECIALIZATION-DIVERSIFICATION
1962-64 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
8	13,251,000	73.313	73.313
9	3,825,000	21.162	94.475
10	334,500	1.851	96.326
7	166,100	.919	97.245
6	161,900	.896	98.141
5	106,200	.588	98.729
3	76,700	.424	99.153
2	72,100	.399	99.552
12	29,900	.165	99.717
1	29,200	.162	99.879
11	15,100	.084	99.963
13	4,600	.025	99.988
4	2,200	.012	100.000
Totals	18,075,000	100.000	1,256.481

TABLE A-XV

PORT OF BUFFALO INDEX OF SPECIALIZATION-DIVERSIFICATION
1954-56 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
8	6,512,100	30.500	30.500
9	4,313,600	20.203	50.703
6	3,973,000	18.608	69.311
2	3,142,000	14.716	84.027
10	1,752,850	8.210	92.237
7	990,300	4.638	96.875
3	309,250	1.449	98.324
11	236,150	1.106	99.430
12	106,000	.496	99.926
5	8,000	.038	99.964
13	7,500	.035	99.999
1	200	.001	100.000
4	0	0	100.000
Totals	21,351,000	100.000	1,121.296

TABLE A-XVI

PORT OF BUFFALO INDEX OF SPECIALIZATION-DIVERSIFICATION, 1962-64 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
8	6,732,600	41.362	41.362
9	2,978,800	18.300	59.662
2	2,288,900	14.062	73.724
6	2,017,700	12.396	86.120
7	904,000	5.554	91.674
10	817,500	5.022	96.696
12	199,700	1.227	97.923
3	133,400	.820	98.743
11	124,900	.767	99.510
5	78,200	.480	99.990
1	1,300	.008	99.998
13	300	.002	100.000
4	50	0	100.000
Totals	16,280,000	100.000	1,145.402

TABLE A-XVII

CALCITE, MICHIGAN INDEX OF SPECIALIZATION-DIVERSIFICATION, 1954-56 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
9	15,607,500	99.185	99.185
6	127,900	.812	99.997
5	500	.003	100.000
1	0	0	100.000
2	0	0	100.000
3	0	0	100.000
4	0	0	100.000
7	0	0	100.000
8	0	0	100.000
10	0	0	100.000
11	0	0	100.000
12	0	0	100.000
13	0	0	100.000
Totals	15,735,800	100.000	1,299.182

TABLE A-XVIII

CALCITE, MICHIGAN INDEX OF SPECIALIZATION-DIVERSIFICATION, 1962-64 AVERAGE

Commodity group	Commodity tonnage	Group as a per cent of port total	Cumulative percentage
9	12,322,000	99.387	99.387
6	76,000	.613	100.000
1	0	0	100.000
2	0	0	100.000
3	0	0	100.000
4	0	0	100.000
5	0	0	100.000
7	0	0	100.000
8	0	0	100.000
10	0	0	100.000
11	0	0	100.000
12	0	0	100.000
13	0	0	100.000
Totals	12,398,000	100.000	1,299.387

TABLE A-XIX

RELATIONSHIP OF THE SIX MAJOR PORTS AND GREAT LAKES WATERBORNE FOREIGN COMMERCE BY VALUE AND TONNAGE IN THREE YEAR AVERAGES, 1953-1964
(Thousands of Tons and Millions of Dollars)

	1953-55	1956-58	1959-61	1962-64
Port of Chicago				
Tonnage	1,795	2,083	2,762	5,207
Per cent of Great Lakes total	6.3	6.5	7.8	11
Value	118.1	166.0	311.8	487.9
Per cent of Great Lakes total	22	23.8	29.1	28.8
Duluth-Superior				
Tonnage	3,809	3,943	4,426	4,830
Per cent of Great Lakes total	13.5	12.3	12.5	10.3
Value	45.5	45.2	132.9	198.1
Per cent of Great Lakes total	8.5	6.5	12.4	11.7
Toledo				
Tonnage	5,123	5,804	6,729	8,048
Per cent of Great Lakes total	18.1	18.3	19	17.1
Value	66.1	75.9	132.3	217.3
Per cent of Great Lakes total	12.3	10.9	12.4	12.8
Detroit				
Tonnage	943	1,719	2,911	3,654
Per cent of Great Lakes total	3.3	5.4	8.2	7.8
Value	58.4	79.0	143.8	218.1
Per cent of Great Lakes total	10.9	11.3	13.4	12.9
Cleveland				
Tonnage	911	1,290	2,900	4,132
Per cent of Great Lakes total	3.2	4	8.2	8.8
Value	32.7	52.3	94.3	118.1
Per cent of Great Lakes total	6.1	7.5	8.8	7.0

TABLE A-XIX (continued)

	1953-55	1956-58	1959-61	1962-64
Buffalo				
Tonnage	1,899	2,033	1,207	2,093
Per cent of Great Lakes total	6.7	6.4	3.4	4.4
Value	43.9	35.5	28.1	34.5
Per cent of Great Lakes total	8.2	5.1	2.6	2.1
Six Major Ports				
Tonnage	14,460	16,890	20,925	27,960
Per cent of Great Lakes total	51.1	52.9	59.1	59.4
Value	364.7	453.9	843.2	1,274.0
Per cent of Great Lakes total	68	65	79	75
All of the Lake Ports				
Tonnage	13,857	15,059	14,490	19,108
Per cent of Great Lakes total	48.9	47.1	40.9	40.6
Value	171.3	244.1	227.8	422.0
Per cent of Great Lakes total	32	35	21	25

Source: For Value; United States Foreign Trade; Waterborne Trade Statistics (Summary Report FT 985), United States Bureau of the Census, Foreign Trade Division, Washington, D. C., Annual Since 1951. For Tonnage; Waterborne Commerce of the United States, Part III, Dept. of the Army, U. S. Corps of Engineers, Waterborne Commerce Statistics Center, New Orleans, Louisiana, Annual Since 1954; and United States Foreign Waterborne Commerce, Great Lakes Area, Bureau of the Census, Division of Foreign Trade, Washington, D. C. Annual Since 1955.

TABLE A-XX

GREAT LAKES FOREIGN WATERBORNE COMMERCE LINKAGES BY TRADE AREA 1955-1958
(Thousands of Tons of 2,000 Tons)

Trade Area	1955		1956		1957		1958	
	Tons	Per cent	Tons	Per cent	Tons	Per cent	Tons	Per cent
Total Great Lakes	30,824	100	35,869	100	34,555	100	25,437	100
Exports	22,064	100	25,016	100	24,441	100	17,454	100
Imports	8,760	100	10,853	100	10,114	100	7,983	100
Great Lakes Canada[a]	27,939	90.64	31,982	89.16	30,619	88.61	22,421	88.14
Exports	21,243	96.28	24,113	96.39	23,396	95.70	16,702	95.70
Imports	6,896	78.72	7,869	72.70	7,224	71.42	5,718	71.63
Atlantic Canada	2,250	7.30	3,313	9.24	3,417	9.89	2,309	9.08
Exports	532	2.40	622	2.49	756	3.10	391	2.24
Imports	1,818	20.75	2,691	24.80	2,661	26.30	1,918	24.03
Carribean	13	.04	17	.05	10	.03	33	.13
Exports	5		9		8		21	
Imports	8		8		2		12	
West Coast South America	--	--	1	--	--	--	--	--
Exports	--		1					
United Kingdom and Ireland	74	.24	96	.27	113	.33	159	.62
Exports	43		57		65		86	
Imports	31		39		48		73	

TABLE A-XX (continued)

Trade Area	1955		1956		1957		1958	
	Tons	Per cent	Tons	Per cent	Tons	Per cent	Tons	Per cent
Scandinavia, Baltic, Greenland and Iceland	126	.41	160	.45	104	.30	132	.52
Exports	63		59		43		64	
Imports	63		101		61		68	
Bayonne-Hamburg Range	236	.76	226	.63	185	.53	268	1.06
Exports	120		112		103		114	
Imports	116		114		82		154	
Portugal and Spanish Atlantic	12	.04	12	.04	10	.03	15	.06
Exports	1		2		1		1	
Imports	11		10		9		14	
Azores, Mediterranean, and Black Sea	71	.23	61	.18	93	.27	95	.38
Exports	54		40		63		70	
Imports	17		21		30		25	
Africa	3	--	1	--	4	--	5	--
Exports	3		1		4		5	

[a]Includes Montreal and all ports west.

Source: United States Waterborne Commerce, Great Lakes Area (Annual Since 1955), United States Bureau of the Census, Foreign Trade Division, Washington, D. C.

TABLE A-XXI

GREAT LAKES FOREIGN WATERBORNE COMMERCE LINKAGES BY TRADE AREA 1959-1963
(Thousands of Tons of 2,000 lbs.)

Trade Area	1959		1960		1962		1963	
	Tons	Per cent	Tons	Per cent	Tons	Per cent	Tons	Per cent
Total Great Lakes	35,399	100	35,852	100	40,864	100	46,341	100
Exports	20,533	100	23,002	100	25,216	100	28,340	100
Imports	14,866	100	12,850	100	15,648	100	18,000	100
Great Lakes Canada[a]	25,548	72.17	25,926	72.32	25,325	62.00	27,627	59.62
Exports	17,449	85.00	18,300	80.00	17,022	67.50	19,667	69.40
Imports	8,099	54.47	7,626	59.34	8,303	53.06	7,960	44.22
Atlantic Canada[a]	5,935	16.77	5,070	14.14	9,465	23.16	13,174	28.43
Exports	251	1.22	726	3.16	3,268	12.96	4,644	16.40
Imports	5,684	38.23	4,344	33.81	6,197	39.60	8,530	47.39
Caribbean	307	.86	282	.78	130	.32	214	.46
Exports	195		191		78		109	
Imports	112		91		52		105	
South America	1		49	.14	29	.07	62	.13
Exports	1		18		25		56	
Imports			31		4		6	
Central America and Mexico	23	.06	60	.16	67	.18	71	.15
Exports	--		--		1		--	
Imports	23		60		60		71	

TABLE A-XXI (continued)

Trade Area	1959		1960		1962		1963	
	Tons	Per cent	Tons	Per cent	Tons	Per cent	Tons	Per cent
United Kingdom and Ireland	627	1.77	617	1.72	806	2.00	882	1.90
Exports	520		520		680		678	
Imports	107		97		126		204	
Scandinavia, Baltic, Iceland and Greenland	409	1.15	482	1.34	394	.98	354	.76
Exports	266		399		259		230	
Imports	143		83		135		124	
Bayonne-Hamburg Range	2,177	6.15	2,520	7.03	2,982	7.30	2,390	5.16
Exports	1,582		2,183		2,490		1,760	
Imports	595		337		492		630	
Portugal and Spanish Atlantic	47	.13	77	.21	79	.20	70	.15
Exports	9		37		28		30	
Imports	38		40		51		40	
Azores, Mediterranean, and Black Sea	276	.78	513	1.43	867	2.12	588	1.26
Exports	220		399		798		513	
Imports	56		114		69		75	

TABLE A-XXI (continued)

Trade Area	1959		1960		1962		1963	
	Tons	Per cent	Tons	Per cent	Tons	Per cent	Tons	Per cent
Africa	9		18	.07	47	.13	97	.20
Exports	4		18		47		84	
Imports	5		--		--		13	
Australia	--	--	--	--	27	.06	43	.09
Exports	--		--		13		22	
Imports	--		--		14		21	
India, Persian Gulf, Red Sea	28	.08	127	.35	207	.49	160	.34
Exports	28		125		199		141	
Imports	--		2		8		19	
Remainder of Asia	12	.03	108	.30	438	1.10	609	1.32
Exports	12		85		306		406	
Imports	--		23		132		203	

[a]After 1961 Montreal is included in Atlantic Canada, and excluded from Great Lakes Canada.

Source: United States Waterborne Foreign Commerce, Great Lakes Area (Annual Since 1955), United States Bureau of the Census, Foreign Trade Division, Washington, D. C.

FUNCTIONAL CHANGES IN THE MAJOR UNITED STATES GREAT LAKES PORTS SINCE THE OPENING OF THE NEW ST. LAWRENCE SEAWAY

by

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AN ABSTRACT OF A MASTER'S THESIS

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Completion of the new St. Lawrence Seaway in 1959 marked the beginning of very significant changes in the characteristics of Great Lakes Shipping. What had been virtually a system of inland waterways serving the movement of regional commerce was effectively opened to ocean shipping. The new 27-foot waterway transformed the Great Lakes into America's "fourth seacoast" as vessels of moderate size could move directly between lake ports and the world's oceans.

This paper is a study of changes that have occurred in Great Lakes shipping following the waterway improvement. Attention was directed to the seven United States Great Lakes ports handling the greatest cargo tonnages. Shifts in volume, composition, and direction of freight movements were measured and compared over a twelve year period, 1953 to 1964. Trends observed for the seven principal ports were contrasted with regional and national changes over the same period.

Significant shifts have occurred within the major ports in the post-seaway period. Changes were observed in the levels of tonnage and in the composition of cargo. The most important changes occurred in the value and direction of freight movements. The historical dominance of regional movement has diminished in all of the major ports. An increasing orientation toward foreign trade was measured for

all seven ports. New overseas links were forged and previous linkages were reinforced by dramatic increases in tonnages coincident with the opening of the new seaway.

An increase in foreign trade, both in value and tonnage, resulted in an increase in the share of the seven major ports in total regional and national traffic. The major lake ports handled more cargo and more valuable cargo during a period of regional and national foreign trade expansion.

Changes in individual ports varied widely. Mapped variation revealed that the greatest redistribution of freight flows has taken place in ports at the eastern and western ends of the Great Lakes. Location with respect to the Great Lakes and interior transportation connections produced different changes in traffic flows for each port. All of the ports except Buffalo responded favorably to the improved waterway conditions.

In those ports with competitive advantage in access to the Great Lakes hinterland the value of exports has generally increased proportionately to the value of imports, while a wider range of commodities has been handled. Chicago, Duluth-Superior, and Toledo are among these. The remaining ports, because of more restricted hinterland accessibility, have without exception become more specialized in the composition of commodities handled. Detroit, Cleveland, and

Buffalo have recorded disproportionate gains in the value of imports relative to exports while concentrating receipts in a more narrow range of commodities.

Through 1964, a progressive rank-size hierarchy was absent in the principal lake ports despite the significant increases in seaway traffic and the gains recorded for the individual ports. It was clear that all of the principal ports experienced important changes which were indicative of the seaway's broad impact.